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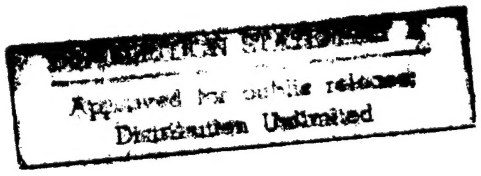
2 January 1985

West Europe Report

SCIENCE AND TECHNOLOGY



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WEST EUROPE REPORT

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AEROSPACE

FRG STUDY LOOKS AT PARTICIPATION IN ESA, U.S. SPACE STATION

Munich FLUGREVUE in German Oct 84 pp 30-31

[Article by Goetz Wange: "Studies: BDLI and DFVLR. The Future of Space Travel"]

[Text] Plenty of recommendations have been made--now the politicians must decide. At the present time the foundation is being laid for the course which German space travel will follow in the future. Strategic studies have been prepared by industry and the German Research and Development Institute for Air and Space Travel (DFVLR).

In reality, all of the decisions have already been made. As they have done so often in the past, the French have taken over control of the European space travel program and all the Germans can do now is to agree with them. At least this is how the political situation could be described prior to the upcoming October meeting of the European ministers for research, at which they will decide upon a strategy for subsequent negotiations with the U.S. on participation in the U.S. space station project. Already in June, French Prime Minister Laurent Fabius--at that time he was still the minister for industry and research--came out in favor of further development of the European Ariane-5 booster rocket, and later also supported participation in the American space station program. Chancellor Helmut Kohl is also supposed to have given similar assurances during talks in Paris and Washington.

It has been decided, then, that Europeans will participate. The only remaining question is where the money will come from. And this question must be well considered, because bad decisions would not only jeopardize the public image of space travel, but could also cause long-term economical damage.

Those critics who view the space travel business only as a way of putting communications satellites into orbit must be shown that experiments involving materials and liquids at zero gravity in the space station and on free-flying platforms could lay the foundation for the sophisticated technologies of the year 2000--not to mention the fact that the Japanese have quadrupled their budget for space travel in the past 10 years and, with an annual budget of $516 million, have left France ($458 million) and the FRG ($309 million) far behind (figures are for 1982).

The demand that the FRG's budget for space travel be increased is pointless in and of itself, if suggestions are not made at the same time for practical use of such funds. The Federal Ministry for Research and Technology (BMFT) therefore had a strategic study prepared which has been used in Bonn since the middle of April as an aid in the decision-making process. The study, prepared by the DFVLR, states that an increase in the FRG's budget to roughly DM 1.3 billion is necessary in order to participate in the program of the European Space Agency and in order to lift the FRG to a leadership position equal to that of France. This would mean an increase of around DM 400 million over the current budget. As a comparison, the French budget for 1984 is already DM 1.5 billion.

Greater Independence From U.S. Urged

In addition, the memorandum of the Federal Association of the German Air Travel, Space Travel and Equipment Industries (BDLI) submitted in August reads as follows: "Space travel is becoming an increasing economic factor. France realized this trend in time, and adjusted the national space travel budget accordingly. In the FRG, on the other hand, this has not been done."

The BDLI recommends that the European space travel program be relatively independent of the U.S., and supports a strong Franco-German alignment. The FRG should assume a leadership role in manned space travel just as France has done in the development of the Ariane booster rocket. In the case of serviceable free-flying systems, the industry wants close cooperation with the U.S., whereby the possibility of European autonomy should be kept open and fair conditions should be negotiated "on the basis of demonstrated performance."

The strategic study prepared by the DFVLR makes the same recommendation. On the subject of the type of partnership with the U.S. with regard to the space station, the experts suggest that each partner only assume those costs and risks associated with his share of the program. Vehicles use is subject to negotiation. The study makes the following statement: "The goal of the European space program could be the development of European components such as a single 'common module' derived from Spacelab and/or serviceable platforms, whereby the U.S. would agree not to develop its own such components, negotiated as exclusive European contributions to the space station program. At the very least, however, guidelines must be agreed upon for European access to and use of the space station and for American support in the operation of the European components and compensation of the resulting costs."

Under the leadership of the minister for research and technology, Heinz Riesenhuber, the government of the FRG wants to establish initial budgeted amounts for a new space program at the beginning of October. Although he will certainly be able to increase the current budget for the space program as compared to the other budget items, he will have to make some cuts. The Ministry of Finance has already labeled as "illusory" an average increase of DM 600 million. For this reason, DFVLR experts have already included in their strategic study possible cuts as alternatives to a "full-fledged program."

Because a stretching-out of the overall program over a longer period of time is seen as inconsistent with its goals, the following suggestions have been made:

- Shelving of the planned qualification of the Ariane 5 for manned flights. Technically, however, this option should remain open (development of the European shuttle).

- The laboratory module, as a European contribution to the U.S. space station, should be developed without a service module, a change which would not jeopardize the goals of the program, but would make free flight of the European module impossible when not docked with the U.S. station.

- Shelving of the service vehicle which connects serviceable platforms with the shuttle, the space station or an independent return system.

- Shelving of a European data relay satellite system or leasing of such a system to be developed in Europe.

- Financing by the users of the polar platform planned for land observation and surveillance.

If all of these suggestions were implemented, the average German budget for 1986 to 1997 would be around DM 1.05 billion. However Europe would then have to purchase some services from NASA, not all of which could be compensated by return business. "The original cuts in development spending would later result in financial obligations of nearly the same order of magnitude," the DFVLR study indicates. It is therefore recommended that only some of the listed cuts be implemented.

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CSO: 3698/107

BBC OF SWITZERLAND DEVELOPS ELECTRIC CAR

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 2 Nov 84 p 7

[Article: "Electric Car Could Have Great Market Potential as Second Car: Any AC Outlet Can be Used to Give the Battery a Normal Charge Overnight"]

[Excerpts] (RE) Frankfurt--The first milestone on the road to a high-performance electric car has been reached. Although the car has not yet been produced, its technical details are already known--at least from the perspective of the battery manufacturer: It will have a maximum speed of 130 km/h, will be used for in-city driving at the posted speed of 50 km/h and on highways at 70 km/h. It will be able to accelerate from 0 to 150 km/h in seven seconds, and will have a range of 250 km at a touring speed of 100 km/h. These data, presented by Dr Hans Kahlen during the seminar entitled "Energy" sponsored by Brown Boveri et Cie (BBC) in Baden Baden as target values of his development group, no doubt give the car great market potential as a second car, provided that the high-energy battery currently under development performs as promised, Kahlen says.

After preliminary investigations, BBC decided in 1973 to develop a new system capable of holding considerably more stored energy. Sodium (Na) and sulfur (S) were chosen as the raw materials for two reasons: There is an adequate supply of these materials and even great demand should not make them significantly more expensive, and the energy density (amount of energy per unit weight) of a sodium-sulfur battery (NaS) is three to five times higher than that of lead-acid batteries.

Other firms carried out experiments using other materials, however in almost every case they led to dead ends: The lithium-sulfur battery was found to be technically impossible to manufacture (at the present time), the nickel-iron and nickel-cadmium batteries for electric cars were too expensive and the zinc-chlorine battery required too great a volume. The only battery which had potential was the zinc-bromine battery, even though its energy density (60 watt-hours per kg) is only about half as great as that of the sodium-sulfur battery (90-100 watt-hours per kg).

In 1974 BBC began parallel development of drive systems which were limited at the outset to passenger cars, panel trucks and small buses. The result of

this development is a direct-current drive with gearbox and control electronics, the prototypes of which are currently being tested in the electric VW Golf.

According to Kahlen, the energy supply infrastructure already exists to a large extent: Any 220 VAC electrical outlet can be used to give the battery a normal charge overnight. Additional facilities are required only for quick-charging and--even quicker--battery replacement at the "filling station". However the developers are already in agreement about the car's "consumption": The electric car requires approximately 20 kWh for a distance of 100 km, BBC reported.

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CSO: 3698/107

BRIEFS

FRG CERAMIC ENGINE COMPONENTS--(PET) Frankfurt--In testing ceramic components for spark ignition and diesel engines it has been shown that design engineers face particular problems in the development of ceramic rotors and ceramic-lined turbocharger housings. As determined by the Federal Ministry for Research and Technology on the basis of studies within the scope of this project, today's manufacturing methods are pushed to the limit of technical feasibility. "Here, basic research must be continued, however additional improvements in manufacturing technology and quality control must also be made," said the Ministry. Nevertheless, some methods of improvement have already become apparent. Ceramic port liners for thermal insulation of the exhaust gas channel in the cylinder head, for example, can already be cast into the cylinder head using improved manufacturing methods. Less heat would be given off by the cooling system, the exhaust temperatures would rise, hydrocarbon emissions would drop by 10 percent and catalytic treatment of the exhaust gases would be made more favorable, the Ministry continued. Similar attempts have been made to line the exhaust manifold. Currently, however, it is extremely difficult to manufacture the necessary shape while simultaneously adhering to close manufacturing tolerances. According to the Federal Ministry for Research and Technology, the ceramic lining of the combustion chamber still requires more development in spite of some partial successes. Of primary importance are designs which lend themselves to ceramic linings, as well as the selection of suitable ceramic materials. The objective of the development of ceramic engines is the reduction of fuel consumption by nearly eight percent, to be made possible primarily by higher operating temperatures. In order to do this, however, engine heat losses must be minimized, a task for which ceramics are suitable in principle. This goal is so attractive that intensive work should continue on this research project, said the Federal Ministry for Research and Technology. The research board comprises the firms of Audi, Kloeckner Humboldt Deutz AG, Kuehnle, Kopp und Kausch, and Rosenthal Technik. [Text] [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 1 Nov 84 p 7] 12644

CSO: 3698/107

CIVIL AVIATION

DESCRIPTION OF MBB COMPUTERIZED DESIGN TECHNIQUES FOR A320

Duesseldorf VDI NACHRICHTEN in German 28 Sep 84 p 26

> /Text/ For the first time in the history of civil aircraft construction in Europe, an airplane is no longer being designed on the drawing board. Picture screen, light marker, and computers are now exclusively the means with which MBB /Messerschmidt-Boelkow-Blohm/ is building the new Airbus A320 aircraft. Complete major structural parts, components, as well as metal and synthetic material structures, down to the smallest sheet metal parts and connection elements are being drawn on the picture screen, the data of these drawings are stored in computers, they are preserved on magnetic tape for use as construction documents, and they are reproduced on microfilm or they are printed out on paper.

With the help of billions of tiny information units (bits) it is possible, with the help of the graphic picture screen system Cadam (Computer Graphics Augmented Design and Manufacturing) to produce mathematically exact pictures and drawings for the new Airbus A320. Work is being done on this new development at around 100 display screen stations in the Hamburg and Bremen development and design centers of the transport and passenger aircraft division of MBB.

Using the pertinent software, two-dimensional pictures of the aircraft can be done in a matter of seconds: Full views, profiles, and detail drawings. The various motives can be related to each other also in terms of space via transformation parameters in this method of making drawings. In this way one can use a quasi-three-dimensional image.

Compared to conventional work on the drawing board, this kind of development and design work results not only in a considerable time gain but above all also greater accuracy. For example, if we use the light marker to draw a line on the 40 cm x 40 cm display screen surface, this line--supported by the computer model of Cadam software--will be many times more accurate than a line drawn with the ruler on the drafting board. The electronic line comes very close to the mathematical straight line.

Drawings on the display screen can be reproduced as often as desired. Corrections or changes in drawings are programmed immediately, and every drawing, every drawing detail is stored in the computer and can be retrieved instantly. The economic gain deriving from the graphic display screen system is found primarily in direct data transfer from design to production but also in the considerably smaller expenditure connected with design changes.

With the help of the software, for example, one can show on the picture screen a previously drawn structural component from various angles and out of this particular structural component one can "take out" a certain detail, one can enlarge it, and one can illustrate it for correction or change all by itself. Illustration possibilities using Cadam are almost unlimited.

Everything needed for the A320 is being developed and designed with the help of this system at MBB. That includes the mechanisms in which the aircraft is to be built, the production equipment, with which the aircraft is to be built, and the metal and synthetic material parts for the structures and systems of the aircraft itself.

In detail design--which, at MBB, on the basis of the construction job subdivision of the Airbus partners, includes essential parts of the fuselage and the tail assembly--every piece of metal or synthetic substance, which belongs to a structural unit, is drawn on the image screen with the light marker and is assembled into small structural components (for example, frame segments, stringers, chips, and retaining devices for the cable trees).

An important job on the display screen involves the drawing of the milling parts, complex aluminum or titanium structures, which are milled out of huge sheets in a single operation. The geometry of the milling parts can be transmitted to the milling machines in the central MBB cutting plant in Varel (near Wilhelmshaven) in the form of direct "running orders" via a post office line for example from Hamburg or Bremen. The milling parts can be made in practice without the detour via the drawing and further programming of the numerically controlled milling automats.

For general production--for example, the production of structural components made of aluminum or carbon-fiber-reinforced working materials, the production of fuselage shells, the assembly of fuselage sections and of the rudder assembly--production documentation down to the last detail is supplied via the graphic system. This is done in the following manner: After the computer has stored the structural parts designed with the help of Cadam, the data are reproduced in an illustrated fashion with the help of microfilm without the detour via a drawing. The display screen illustrations on the microfilm are enlarged and are supplied to the work station with a "work card." Here the picture, provided with all geometric data, replaces the former work piece or assembly drawing. On a display screen one can then make the enlarged microfilm image visible and legible.

In addition to that, it is possible to produce larger drawings of structural components, stored by Cadam, also with the help of a plotter. A plotter is an electronically controlled, automatically working drawing system. Rapidly advancing technological development in the aircraft industry leads to ever shorter production cycles. The Cadam graphic display screen system is an aid in being able to follow this trend also in development, design, and production.

5058
CSO: 3698/94

DELIVERY TIMES CAUSE CASHFLOW PROBLEMS FOR AIRBUS INDUSTRIE

Munich INDUSTRIEMAGAZIN in German 15 Oct 84 pp 128, 133

> /Text/ Undismayed the Airbus Industrie syndicate flies in pursuit of the break-even point. The deal with PanAm did, to be sure, result in more orders for it but there is a dry spell ahead when it comes to deliveries.

Compliments, contacts, and combinations are available aplenty: "The new A-320 is a project which, in terms of its technical brilliance, is hardly surpassed by any other aircraft," said Reinhard Abraham, deputy board chairman of Deutsche Lufthansa, in praising the advantages offered by this latest product of the Airbus Company.

Others obviously see the situation the same way. The European syndicate is conducting intensive talks with the PRC concerning the purchase of its airplanes and a Soviet delegation recently discussed production cooperation possibilities at the Airbus headquarters in Toulouse concerning the construction of large-size aircraft. At the same time, a contract with PanAm, an American airline, on the purchase of 28 Airbuses, options for another 47 aircraft, and the leasing of 16 aircraft now "stockpiled" in Toulouse put an end to the company's many long years of slow sales. But the deal will bring financial backup support for Airbus ambitions only in longer-range terms (see graph).

It is precisely this secure backup support which Airbus Industrie and its partners in the FRG, Deutsche Airbus GmbH (limited liability company) in Munich need all the more, since, following the forceful action by European governments in financing past programs, prospects for similar generous aid from the public treasury do not look too rosy. "In my opinion, the partners may expect this kind of aid again only if the money spent for the Airbus programs flows back more abundantly than has been the case so far and if the viability of European civil aircraft construction has thus been demonstrated," emphasized Abraham of Lufthansa.

The demand for evidence as to viability is something which sales chief Pierre Pailleret would of course love to hand back to the German carrier: Because Lufthansa during this business year likewise (following DM280

million operating profit in 1983) once again wishes to show a good result and has almost DM200 uncommitted reserves, it is especially its purchasing decision that is included among the signals which Munich and Toulouse are waiting for most urgently. Here, a juicy downpayment would probably be even more vital for the Airbus supplier.

In the meantime, Airbus Industrie naturally was very happy over the leasing of some of the A-300 models by PanAm which are mothballed in Toulouse. In addition to the lower maintenance and financing expenses, this deal gives the syndicate above all also the benefit of an important new customer on the hard-fought American market.

The enterprise tried to open this breach all the more stubbornly since the slow sales during the two prior years on the aircraft market had caused serious trouble for it. "Because of declining factory orders, we had to cut the output rate back from 4.6 to 4 aircraft per month," complained sales boss Pailleret. During 1985, deliveries for the time being will continue to go down to three units. "But, in return, we got more new orders with 22 units already during the first half of 1984 than throughout the entire preceding year," said Russell Shanahan, director of the sales staff section at Deutsche Airbus by way of consolation.

This observation applies inasmuch as a total of only 18 orders came in during 1983. But the increased number of new orders does not yet guarantee any broader stream of deliveries during the next couple of years especially since it contains orders for the A-320 which is not yet ready for series production.

Balance Sheet Loss

Because the lead time between orders and deliveries at Airbus Industrie is roughly a year and a half, Shanahan at any rate figures that the company will again be working at its capacity limit of 50-55 aircraft annually in 1986; that figure can be achieved through single-shift operation and without any expansion investments.

That this full utilization rate should be achieved as quickly as possible is of course something that is also wanted by MBB /Messerschmidt-Boelkow-Blohm/ which, after the merger with VFW /Volkswagen Works/ moved up to the position of sole partner of Deutsche Airbus and that had to accept losses of its affiliate amounting to around DM310 million during the 1983-1984 fiscal year. Overall, MBB so far has invested around DM1.2 billion of its own money in the development and production of the Airbus.

This is why it is no wonder that the German Airbus partner by no means regrets his smaller share of the work on the new Airbus A-320 (31 instead of the previous 35 percent). The partial German withdrawal from the A-320 project raised the British share to 27 percent and the Spanish partner, Casa, also added a little bit with 6 percent. The French share remains at 36 percent.

MBB and Deutsche Airbus by the way got into the program for the production of this model by no means with any great enthusiasm. Of course, the syndicate strategists could not fail to realize that the Airbus Group had to broaden its product assortment if it wants to work more efficiently and manage more profitably. Boeing during the preceding year at any rate was able to deliver 187 aircraft whereas Airbus Industrie delivered only 44 aircraft.

The gap between the American market leader and its European pursuer thus is still quite big although "family planning" in the House of Airbus is designed to reduce that gap in the future. Following the 250 firm orders for the A-300, which were recorded over the years, the smaller A-310 got all the way up to 110 orders.

Market Forecast

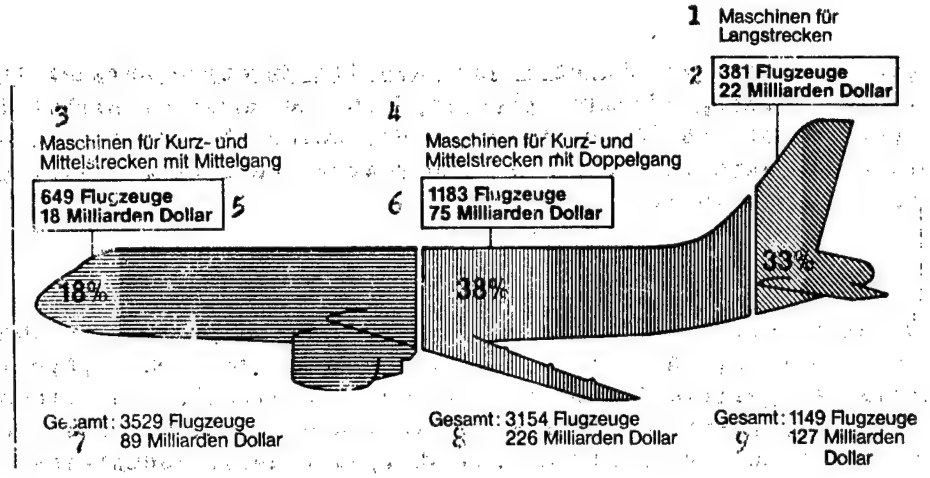
As for the 150-seat A-320, 37 firm orders were recorded from the drawing-board stage on. Starting in 1988, at last, the four-jet, long-range TA-11 aircraft (series designation A-330) is also to be available and Airbus is now looking for development partners worldwide; among other things, the Group is negotiating in Japan with Mitsubishi, Fuji Heavy Industries, and Kawasaki.

Of course, these projects have a chance only if the long-term market forecasts of the Airbus Group come true. Pailleret estimates the total requirement for airliners over the next 20 years at about 8,000 units due to replacement procurement and rising passenger figures.

Of that number, at least 3,500 aircraft go to the market of the narrow-body aircraft which is particularly interesting for the Airbus at this time. Here, the A-320 must compete with more developed versions of the MD-80 by McDonnell Douglas and the 737 by Boeing but also with the planned Boeing project 7-7.

"In developing this model, Boeing has not yet gotten quite as far as Airbus has with the A-320," Abrahahm of Lufthansa assured us. "But when the situation gets serious, the Americans are mostly faster than the Europeans. In the case of the 7-7, they still have a year for their development decision."

By then, the Airbus Group and its most important potential customers, including Lufthansa, must have a clear takeoff runway. Otherwise they would miss the correct "slot."



Starting on expensive model classes--Airbus sales forecasts, 1984-2002. Key: 1--Aircraft for long-range flights; 2--381 aircraft, $22 billion; 3--short-range and medium-range aircraft with center aisle; 4--short-range and medium-range aircraft with twin aisle; 5--649 aircraft, $18 billion; 6--1,183 aircraft, $75 billion; 7--total: 3,529 aircraft, $89 billion; 8--total: 3,154 aircraft, $226 billion; 9--total: 1,149 aircraft, $127 billion. All three market segments: 7,832 aircraft, $442 billion. Source: Airbus Industrie.

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CSO: 3698/82

NORWAY MAY JOIN INTERNATIONAL ENGINE CONSORTIUM

Oslo AFTENPOSTEN in Norwegian 13 Nov 84 p 16

[Article by Egil Wettre-Johnsen: "Staking 600 Million Kroner: KV [Kongsberg Weapons Plant] Will Take Part in Major Project for New Airplane Engine"]

[Text] On Monday the government advocated the Kongsberg Weapons Plant's taking part in Pratt and Whitney's new airplane engine project with a share of three percent. The American aircraft engine manufacturer is developing a new low-noise and fuel-saving jet engine specially designed for civilian wide-bodied planes. The Norwegian owner's share in the jet engine project will probably amount to about 600 million kroner.

Undersecretary Frode Helgerud of the Industry Ministry reports to AFTENPOSTEN that the government in the course of a couple of weeks will submit a Storting bill for KV's participation in the project. It is expected that the new jet engine will receive a market share of 50 percent in the Western World up to the year 2000. Production can begin in a few years.

Immediately, it is expected that the work force in KV's jet engine division can be increased by 100 employees. However, the government has placed major emphasis on the long-term positive effects of Norwegian participation in the jet engine project: KV will be ensured access to expertise and technology in addition to regular partial production. Participation on the owner's side can also produce long-term positive chain reactions with respect to other similar projects, as well as stimulate other sectors of the KV concern and other Norwegian high-technology industry.

It is expected that the jet engine project will have reliable profitability. KV today has a billion-kroner deficit, and there is reason to believe that increased income as a result of the aircraft engine contract can better arrange the situation for the government's plans regarding partial denationalization of KV.

The occasion for the proposal regarding KV's collaboration with Pratt and Whitney was the exertions in finding alternative projects after the discontinuation of aluminum production in Tyssedal.

If the Storting agrees to the government's bill regarding participation in the aircraft engine project, it is also expected that Odda can gain a considerable increase in number of jobs.

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CSO: 3698/127

NORSK DATA ADDS MATRA TO JOINT VENTURE PARTNERS

Paris VALEURS ACTUELLES in French 12 Nov 84 pp 58-59

[Article by Martine Orange: "The Norwegian Onslaught"]

> [Text] The agreement between Norsk Data and MATRA [Mechanics, Aviation and Traction Company] marks a rapprochement between the Norwegian data-processing industry and European telecommunications companies. A formidable competition for Bull.

The time to unite has finally come: the data-processing company Norsk Data and the French group MATRA managed to arrive at a cooperation agreement that was signed on 29 October. After over one year of negotiations disturbed by outside interventions.

The two partners agreed to develop jointly mini and microcomputer systems. Their goal is to get 10 percent of the scientific market, which is estimated at FF 4 billion.

As a dowry, Norsk Data is bringing its technology, full expertise of supermini architecture, and the performance of its software. As for MATRA, it will give its telecom knowhow, its components production and its powerful sales network.

Through this agreement, the French group intends to develop a new generation of 32-bit scientific work stations, to produce Norsk Data systems in France and sell them throughout southern Europe. For MATRA, this agreement is somewhat like a mere licensing agreement.

At the press conference on 30 October, Mr Jean-Luc Lagardere, chief executive officer of the group, did not conceal his satisfaction at having circumvented all obstacles. His obstinacy enabled MATRA to regain a foothold in data processing: an essential sector from which it had been partially excluded after the failure of its cooperation with the American Datapoint.

Unassuming and with a slight smile on his lips, Mr Rolf Skar, president of Norsk Data, was quietly enjoying his success. His persistence enabled him to realize a six year old project: to gain a foothold in France to improve the company's coverage of the European market. Indeed, it is on this market

that Norsk Data essentially intends to establish itself. For the Norwegian company is convinced that we must have a typically European data-processing industry. Its president explains: "There is a specifically European market. Users are asking for sophisticated products reflecting their needs. Our European company is in a better position to meet these demands than large U.S. manufacturers."

The challenge is mitigated by a good dose of realism: most components are purchased in the United States and in Japan. Peripherals are supplied by manufacturers of all nationalities. The Norwegian company is above all intent on developing gray matter.

Specialized in high-end 16 or 32-bit superminicomputers, Norsk Data has focussed its efforts on the development of intricate architectures and complex software for management, office automation and scientific applications. This policy of customizing caused the company to intensify its research efforts. It is now spending over NKr 100 million, close to 9 percent of its sales (NKr 886 million--Nkr 1 equals FF 1.05) on research. A necessary expenditure, according to Mr Ove Lange, director of industrial strategy: "We must keep promoting new products, for things are changing fast. Data-processing hardware has an average lifetime of 30 months. Fifty percent of the products we are selling today were not on our catalog on 1 January."

The determination to hug the market demand is reflected in the very organization of the personnel. Of a total of 2,100 people, 40 percent are in charge of meeting consumer demands (maintenance, software development, training), 20 percent are employed in sales, 15 percent in research, and only 25 percent in production and administrative tasks.

This offensive strategy, which is supported by the acquisition of other companies, accounts for the strong growth of sales: over 45 percent in 1984, and an expected 58 percent in 1984. Sales should then amount to NKr 1.4 billion.

"Our ambition," Mr Skar confided, " is to become the European data-processing company with the largest profit."

In percentage of the amount billed, that goal has already been reached: Norsk Data reported an operating profit of NKr 127.8 million. In percentage of sales (14.4 percent), that puts it ahead of its main competitors on the European market, such as Digital Equipment, Wang Laboratories or Data General.

The Norwegian company owes these results to its very tight financial management. Rather than making debts with banks, it chose to open its stock. In May 1983, it was registered on the U.S. stock exchange; it thus became the first European data-processing company to gain access to American capital.

To do so, it had to cope with a few difficulties. Norwegian law restricts to 20 percent the share of foreign investors in national companies. However, the government made an exception for Norsk Data, with the provision that shareholders in excess of this quota would have no voting rights. Fifty-four percent of the company's stock is now in foreign hands.

Norsk Data Operating Results (In Thousands of NKr[1])

Item	1981	1982	1983	1984[2]
Sales	481,311	611,248	886,364	503,434
Research expenditures	34,170	41,708	68,636	-
Operating profit	72,618	90,804	127,769	42,230
Net consolidated profit (share of the group)	13,716	25,674	47,156	-
Dividend per share[3]	0.50	1.15	1.15	-

1. One Norwegian crown equals FF 1.05.
2. Results for the first half of 1984.
3. In Norwegian crowns.

Such a strengthening of Norsk Data's financial position made its export policy easier. The same day, on 1 July 1983, the company acquired an 80-percent interest in ND Silvidata AB, a Swedish software and systems house, and in Dietz Computer Systeme, a German minicomputer company. It continued its conquest this year, when it signed a joint-venture agreement with the British firm Racal. In northern Europe, the Norwegian company now possesses solid beachheads through which it sells its hardware.

Norsk Data has already created a French subsidiary. Its sales amounted to NKr 27 million in 1983. Plus 25 million for hardware sold to the European Council for Nuclear Research (CERN) established on the French-Swiss border. But Norsk Data, which is more particularly trying to invest the French scientific market, often came up against Bull's competition.

To circumvent the obstacle and develop a European data-processing industry, Norsk Data has been trying to sign cooperation agreements with French groups since 1978. Prompted by Mr Andre Giraud, then minister of the industry, it started negotiations with Thomson six years ago. The negotiations failed. It renewed its attempt with the Bull group in 1982. Unsuccessfully. The French company did not want to part with its line of Mini 6 minicomputers, as required in the agreement.

Another company was closely watching Norsk Data's approaches in France: MATRA. A few days after giving up its cooperation with the American Datapoint, the French group was contacting the Norwegian firm.

Actually, MATRA was undertaking an "agonizing revision" of its data-processing policy. The alliance with its U.S. partner, which was supposed to lead to joint research, turned out to be a mere subcontracting agreement. MATRA took back its stakes and then decided to turn to the high-level data-processing and microcomputer sectors. From this point of view, Norsk Data appeared as the ideal partner.

The projected rapprochement was not appreciated by all. It put back into question the French data-processing strategy that was centered solely on Bull. Already ailing, Bull was reluctant to accept a French competitor. The dossier

was then shuttled in ministries for many months. As for the Norwegian government, it fully supported the Norsk Data-MATRA project. Even to the point of throwing the economic interests of the two countries into the balance. In particular those of Elf.

According to Odd Goethe, assistant secretary to the Norwegian minister of industry, it did not result in any blackmail: "There is no such thing in Norway as a direct connection like: 'If you award me this contract, I will grant you this oil-drilling permit.' But--there is a but--the fact remains that there is a link between offshore operations and industrial cooperation: it is a long-term commitment."

From pressures to counterpressures, the agreement was signed in the end. This will turn out to be a formidable competition for Bull. For the Norsk Data-MATRA alliance associates very-high-end technological products and telecommunications. Assets which the French data-processing group does not have.

The field of confrontation has already been selected: public contracts. MATRA Datasystems, the new 100-percent owned MATRA subsidiary regrouping the data-processing operations of the French group and the French subsidiary of Norsk Data was assured it would get some of these contracts. Especially those from the National Center for Space Studies (CNES) and the National Center for Telecommunications Studies (CNET).

Bull's only comfort: the authorities did not grant any subsidies to its future competitor.

9294
CSO: 3698/129

EUROPEANS ACTIVE IN MAGNETIC BEARING INDUSTRY

Milan MONDO ECONOMICO in Italian 25 Oct 84 p 69

/Text/ The Romans used it already, although in a rudimentary fashion. This is evidenced by the rotating platform mounted on an imperial ship that sank many centuries ago in the waters of Lake Nemi in Lazio. Leonardo designed them almost the same as those we have today, but of wood, in one of his Atlantic manuscripts. Swedes and Italians early in this century turned it into a real industrial product (see below). But, to revolutionize them, with a sudden spurt so typical of the ambitious technology from beyond the Alps, it took big brains (the equivalent of 13.5 billion lire for research and development) of a highly specialized French company, the Societe de Mecanique Magnetique /Magnetic Mechanics Company/.

Lower Costs

Magnetism is the secret of the new little pad made in Paris. A magnetic field is used here instead of spheres or rollers (which do not entirely eliminate abrasion and vibrations and which are subjected to wear and tear) in order "to suspend" weightlessly the mechanical part which is intended to rotate. Greater speed, less consumption of metal parts, absolute precision (a computer included in the system prevents shifts in the rotation axis and consequently adjusts the force of the magnetic field) are the advantages which, according to company engineers, represent the main advantage of this new product. Less agreeable, at least for the time being, is the price of the "systems" that have been proposed to the user industries (for example, the builders of big industrial plants, huge turbines and compressors): Between $50,000 and $100,000, an appreciable increase compared to the costs of the traditional pads with respect to which however the new type makes it possible to reduce the lubrication and energy consumption expenditures.

Already tested in a 2-billion lire prototype system and sold to pertinent customers (such as Ingersoll Rand, which has installed them as spare parts for old plants), the magnetic pads however promise to have a "smooth" future, especially in medium-range terms. In economic difficulties for quite some time, the French Magnetic Mechanics Company, also known by its abbreviated name S2M, with the help of the new invention managed to get itself a breathing spell already during the last fiscal

year. But its managers have grandiose plans for the next 2-year term and promise tremendous increases in the billing volume.

The main objective of the French is to invade foreign markets for the spherical little pad, markets on which the Swedish Skf was the leader for many decades. To attain that objective, the government in Paris, which owns S2M through the European Propulsion Company (a government company controlled by SNECMA /National Corporation for Aircraft Engine Design and Construction/ which makes engines for the Ariane /rocket/ and ballistic missiles) entered into a compromise that was unthinkable in the past. To sell the little magnetic pads throughout Southeast Asia, as a matter of fact, there is going to be a joint venture, in equal parts, between the French and the Japanese of Seiko; in the meantime, the American market will be pursued by another two-nation company, Magnetic Bearings, in which S2M will join the American Kollmorgen.

Agreement with Seiko

In spite of protests by extreme nationalists, who did not at all like the reactionary aspect of the agreement with Seiko--which gave the former Japanese multinational watch company 10 percent of S2M (20 percent next year)--company managers are convinced that this was a good decision. The Japanese as a matter of fact will be able to open for the little magnetic pad the markets of "mass" users which Seiko has already been taking care of for quite some time through the development of a product of its own which is simplified when compared to the French patent.

Japan's sales power will then make it possible to get the most out of a technological advantage which for the time being exists but which could very soon be challenged by competitors everywhere. Above all Japanese: In the United States, the pertinent companies as a matter of fact never developed their experiments on the magnetic pad to the patent stage (the most advanced studies were those conducted by Cambridge Thermionic), giants such as Toshiba and Hitachi are now moving toward the finish line. What about Skf, the leader? The Swedes are not worried also because they already own 10 percent of the innovative French company.

But the Leader Remains in Sweden [boxed section]

In 1983, it sold the equivalent of 2,400 billion little spherical pads, give or take a billion. With 20 percent of the world market and almost 80 years of knowhow under its belt, the Swedish Skf, in spite of all of the revolutions, for the time being remains the undisputed leader on this market. Founded in 1907 to exploit a technique which was supposed to launch the modern turning pad (the Italian /illegible/ was also born at that time), the company grew in time until it became a multinational outfit of enormous dimensions. Today it has 191 associates and almost 43,000 employees, with establishments all over the world (11 alone in France, eight in Germany, seven in Great Britain) and a vast range of products. Out of the 16 billion crowns billed in 1983 (about 3,500 billion lire), the little spherical pads account for about 65 percent while the rest consists of extremely high-grade steel products, cutting equipment, and mechanical components.

The Italian-controlled member of the group, Riv-Skf, in 1983 had a billing volume of 522 billion and 6,600 employees. Of the four companies constituting it, Officine di Villarperosa is a holding company, Riv-Skf Industries makes the little pads, Rft-Riv-Firgat produces rubber parts, and CIMEC /expansion unknown/ is only a sales company. Negotiations for the purchase of Riv (which was Fiat) on the part of the Swedes were conducted in the middle of the 1960's personally between Giovanni Agnelli and the billionaire Marcus Wallenberg (the family owns 25 percent of Skf), in an exchange that enabled the lawyer to sit on the board of directors of the Swedish giant.

5058
CSO: 3698/125

BRIEFS

FRG-NORWAY RESEARCH COOPERATION--Bonn (R)--The most important joint venture to date in German-Norwegian research cooperation, "Advanced Manufacturing Systems," is to be promoted by funds totaling DM 19 million. This was agreed upon in Oslo by the minister of research and technology, Heinz Riesenhuber, and the Norwegian minister of industry, Jan P. Syse. As the Federal Ministry for Research and Technology stated in this regard, the project concerns the development of multipurpose computer software for designing automatic manufacturing machines, an important prerequisite for competitiveness of German and Norwegian industry. [Text] [Leinfelden-Echterdingen EEE in German 9 Oct 84 p 1] 12644

LASERS IN TOOL PRODUCTION--The Bonn Ministry of Research and Technology has just announced a new research program especially for the use of lasers in making tools for shaping technique. The program has been funded with 2 million FF and is **to be completed in 1987. It calls for close cooperation between the Fraunhofer Institute of Production Engineering in Aachen and the Frankfurt Battelle Institute. Because leading industrial enterprises in the shaping sector will also participate in this, the total research expenditure, according to estimates by experts, will come to more than** FF 5 million. **The program has been justified in the light of the great importance of the drop-forge parts being made in the FRG. Their quantity of about 1 million tons annually roughly corresponds to a world market share of 10 percent. This particular industry branch believes that a better shaping tool is an important key to efficient production,** and also in coping with foreign **competitors. Target-oriented tool treatment is possible by virtue of the high energy density and the relatively easy automatability of laser systems.** This relates, for example, to the treatment of surface and edge areas **thermal conversion hardening, remelting, or also tempering and plating. It is considered certain that the expensive laser systems can be paid off faster with the help of more wear-resistant and thus longer-lasting tools. /Text/ /Bern TECHNISCHE RUNDSCHAU in German 2 Oct 84 p 21/** 5058

CSO: 3698/94

FRENCH RESEARCH ON GALLIUM ARSENIDE DEVICES

Paris REVUE DE PHYSIQUE APPLIQUEE in French Apr 84 pp 325-331

[Article by Y. Segui, B. Moret and D. Montalan, Electrical Engineering Laboratory, 118 Route de Narbonne, 31062 Toulouse Cedex, France, received 25 July 1983, revised 26 December, approved 5 January 1984: "Study of the Electrical Properties of Metal-Polysiloxane-nGaAs Structures"]

[Text] Abstract

The authors show that polysiloxane films deposited by a reactive plasma at room temperature on GaAs substrates can be considered as a possible alternative for the passivation of GaAs devices. The study of transport phenomena show that polysiloxane films exhibit very good insulating properties with electric fields of up to 5 x 10^6 V/cm. The electrical properties of the polysiloxane-GaAs interface are characterized by a U-shaped distribution of interface states in the gap. The minimum value is found at 10^{12} cm^{-2} eV^{-1}. The structures studied offer adequate stability under 80 percent relative humidity and a continued applied field of 1.3 x 10^6 V/cm.

1. Introduction

Thin oxide or nitride films are widely used for insulation or passivation functions in semiconductor devices.

The problem is more complex with gallium arsenide, first because its evaporation temperature requires the use of a low-temperature deposition method and, second, because GaAs surface physics seem to lead to a peak of densities of state that anchors the Fermi level in the lower half of the forbidden band, no matter what material is deposited on the surface.[1] These considerations led us to prepare and test a GaAs-insulator interface in which the insulator is an organometallic polymer deposited by a low-frequency cold plasma.[2]

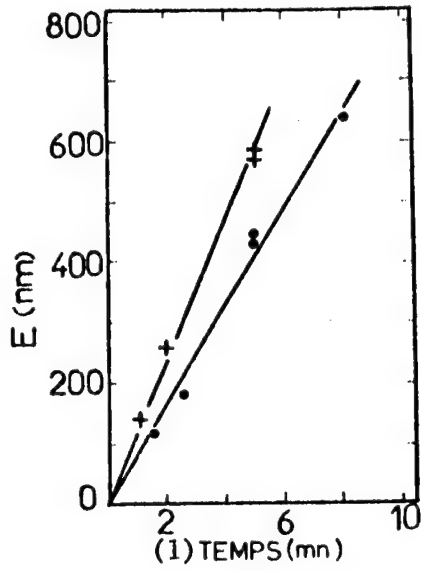

Figure 1. Thickness of the plasma-deposited polysiloxane as a function of time; discharge current: 0.17 mA/cm^2; discharge voltage: 340 V rms; partial pressure of the monomer: ● 0.3 T; + 0.5 T.

Key: 1. Time

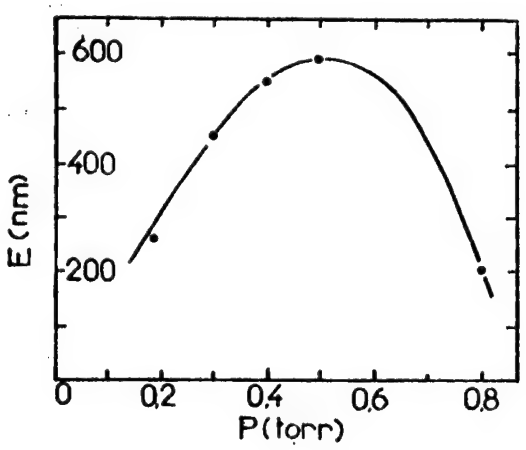

Figure 2. Effect of the partial pressure of the monomer on the thickness of the polymer. Deposition time: 5 min.

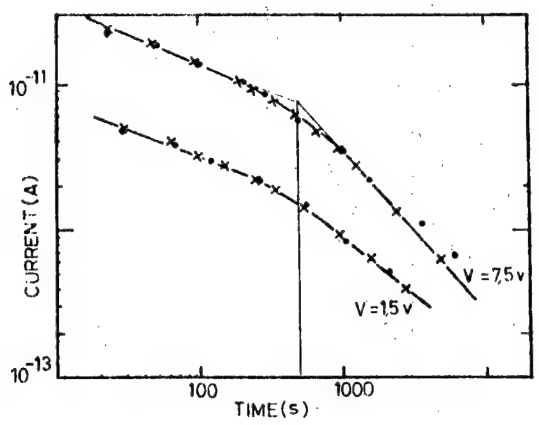

Figure 3. Log-Log plot of the dielectric response to a step voltage. Absorption (X) and resorption (●) currents are superposable. Dielectric thickness: 5,800 Å.

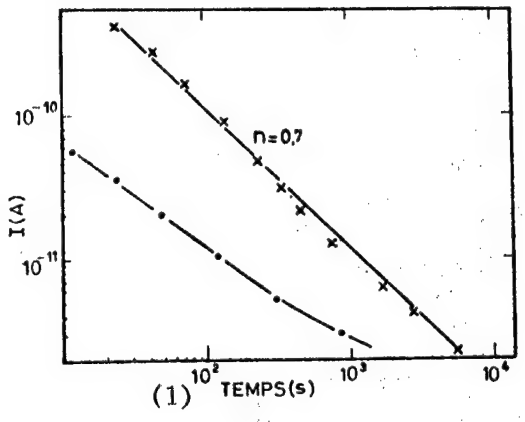

Figure 4. Absorption (X) and discharging (●) currents when a field of 3×10^5 V/cm is applied to the specimen.

Key: 1. Time

2. Plasma Deposition of an Organometallic Film

The deposition of the polymer film is achieved through the creation of a low-frequency plasma in low-pressure vapors of the monomer. The reactor used is of the coplanar type. The most important parameters governing the growth of the solid film on a substrate, from the plasma, are: the partial pressure and the rate of flow of the monomer in the reactor, the current and the frequency of the discharge, the temperature of the substrate as well as geometrical factors.[3,4] The monomer selected for this study was hexamethyldisiloxane, $(CH_3)_3$-Si-O-Si-$(CH_3)_3$. We chose it because of the high thermal stability of the polymer obtained (stable until over 400°C), and because of the vapor pressure of the monomer, which makes it possible to obtain deposits at room temperature, at pressures of 0.2 to 0.5 T, with adequate growth rates. The mechanism of plasma polymerization on a metallized substrate was studied in detail in another paper.[5] The growth of GaAs on a substrate follows the same qualitative laws. Figure 1 shows that, in the thickness range used, growth is linear in time, so that growth rates can be determined. Figure 2 shows the effect of pressure on the growth rate. This bell-shaped curve is well modelled by the approach to the deposition mechanism described in Reference 1. The thickness of the film deposited is uniform within a few percent, and in the 1,000 Å-1 μm thickness range no problem was encountered, even when the specimen was subjected to repeated thermal shocks between 77 K and 473 K.

3. Intrinsic Electrical Properties of Polysiloxane Films

When a voltage step is applied to a dielectric placed between two electrodes and the current resulting from this constraint is measured, we usually observe a current variable in time followed by a steady state.[6]

As far as transients are concerned, three types of behavior were shown to exist.

For weak fields, $E < 2 \times 10^5$ V/cm, the Log I-Log t curves (Figure 3) reveal two linear modes with different slopes. In addition, absorption and resorption currents are equal in absolute value. This phenomenon is characteristic of a dipolar-type behavior.[7]

For stronger fields, the currents remain linear in a Log I-Log t diagram (Figure 4) but can no longer be superimposed. Finally, for fields stronger than 10^6 V/cm, the current vs. time curve is as shown on Figure 5. The latter two experimental facts are interpreted as being the result of an ionic bias that can modify electrical conditions at the electrode-insulator interface and induce electronic injection. The current represented in Figure 5 would therefore be the resultant of an ionic current decreasing with time and an increasing electronic current.

The steady state currents are represented on Figure 6 as a function of the square root of the voltage applied, in the case of a sample 1-μm thick. At room temperature, for a field of 10^6 V/cm, the leakage current is 8.8×10^{-11} A/cm^2, which leads to a resistivity of 5×10^{15} Ω.cm.

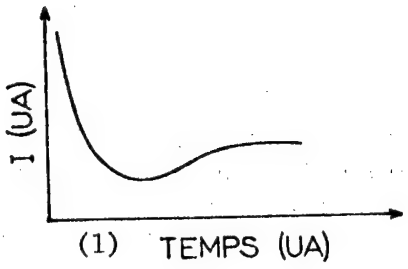

Figure 5. Typical I(t) response when a field of 10^6 V/cm is applied to the dielectric.

Key: 1. Time

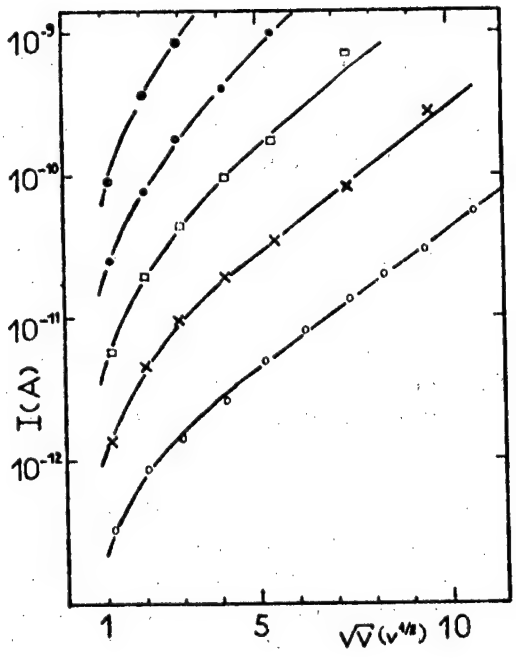

Figure 6. Steady-state (or leakage) currents of the polysiloxane films as a function of the applied voltage. Dielectric thickness: 10,000 Å; temperatures: (○) 23°C, (x) 41°C, (□) 62°C, (●) 83°C, (⊗) 107°C.

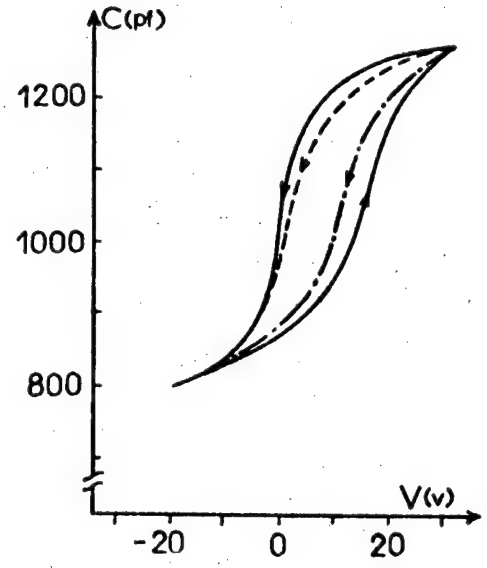

Figure 7. C(V) curves at 1 MHz for an Al-polysiloxane-nGaAs structure, at various sweep rates: —— 0.9 V/s; ---- 4.5 V/s; —·—·— 0.25 V/s.

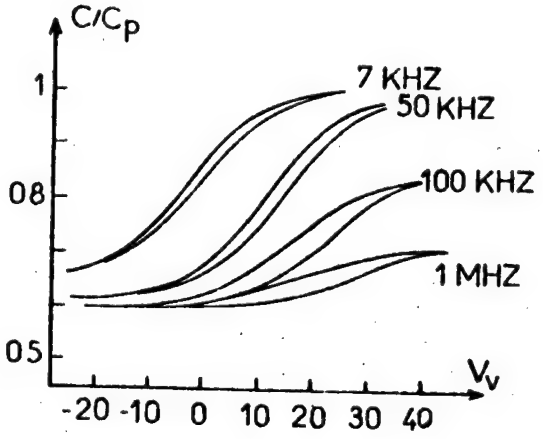

Figure 8. The C(V) dependence at various measuring frequencies for an M-polysiloxane-nGaAs capacitor (N_D = 3 x 10^{16} cm; d = 900 Å).

The dielectric breakdown field is of the order of 5×10^6 V/cm. Note that, until breakdown, the dielectric remains a good insulator and does not show any quasi-exponential growth of the leakage current.

As far as the intrinsic electrical properties of the plasma-deposited polysiloxane are concerned, we can conclude that its behavior is that of an excellent insulator. The only disturbing point as far as passivation is concerned, is the ionic migration which we showed was happening for fields stronger than or equal to 3×10^5 V/cm.

4. Study of the Electrical Properties of the Polysiloxane-GaAs Interface

4.1. Measurement of the Dynamic Capacitance Curve

To investigate this, we used the C(V) characteristics of metal-polysiloxane-nGaAs structures (MPS).

Two types of measurement devices were available:

- for a fixed frequency of 1 MHz, we used a Boonton Type-72 BD capacitance meter;

- for frequencies ranging from 1 kHz to 100 kHz, the capacitance was measured by a PAR type-129-A phase detector.

The C(V) characteristics of MPS capacitances assume the form of an hysteresis loop. The initial direction is clockwise, but after several voltage sweeps the direction is reversed. We also observe that the loop width will vary with the sweep rate (Figure 7).

The first observation shows that the first phenomenon that can be perceived is a mechanism of charge exchange with the semiconductor; then, due to the dissymmetry of the sweeping voltage with respect to the zero voltage, we observe the drain effect that brings the internal charges of the polymer in the region of the interface with GaAs.

The broadening of the loop when the sweep rate decreases is consistent with this assumption.

4.2. Study of C(V) Characteristics As a Function of Frequency

The results presented were obtained for nGaAs substrates (100) that were not doped intentionally, $N_D = 1.8$ at 3×10^{16} cm^{-3}, to ensure that the variations of dynamic capacitance values would be significant.

Figure 8 shows the results obtained for frequencies ranging from 70 kHz to 1 MHz. We observe:

- a considerable frequency scattering on the accumulation side, which is not as marked on the inversion side;

- the well-marked existence of capacitance plateaus both on the accumulation and the inversion sides.

These results we attributed to the presence of a strong density of surface states at the insulator-semiconductor interface. Also note that similar results were reported in the literature for other insulator-GaAs systems.[8,9]

We estimated the distribution and density of these states using the Terman method[10] applied to the C(V) curves obtained with a 1-MHz frequency.

This estimate does not take into account the variations in the value of the relative permittivity of the insulator, as they are negligible in the frequency range covered.

We should point out that the distribution of surface states can be determined only in the lower part of the semiconductor forbidden band. Actually, the measured capacitance values show that, for a frequency of 1 MHz, the value of the surface potential ψ_s vary from -0.6 eV and -1 eV when the voltage ramp is applied.

The densities of surface states, N_{ss}, of M-P-nGaAs systems are shown on Figure 9. These values take into account the presence of charges in the polymer.

The N_{ss} values obtained around the middle of the forbidden band, of the order of 10^{13} cm^{-2} eV^{-1}, are in good agreement with the results obtained by other authors.[11-14]

There is some disagreement on the energy localization of this distribution, as the position of states in the forbidden band is directly related to the knowledge of ψ_s and, therefore, will depend on the method used to determine it.

The imprecision in the value of the surface potential induced by our measurement method does not exceed 5 percent.

4.3. Modelling the Electrical Behavior of M-P-nGaAs Structures

The model proposed to account for the electrical behavior of our structure is represented schematically on Figure 10, with:

R_C, C_P : resistance and compactness concerning the polymer;
R_S, C_S resistance and compactness concerning surface states;
C_C : capacitance of the semiconductor.

The curves obtained from this model to represent $C_{acc}/C_P = f(\omega)$ and $C_{inv}/C_P = f(\omega)$ are in good agreement with experimental points. However, this agreement is obtained by assuming a frequency dispersion of $\tau_o = R_S C_S$ (Figure 11).

The time constant of state surfaces, τ_s, is estimated by the method of conductance in inversion.

For this, we drew the curve representing $G_{SS}(\omega)/\omega = f(\omega)$ for a given voltage. G_{SS} is the conductance of surface states.

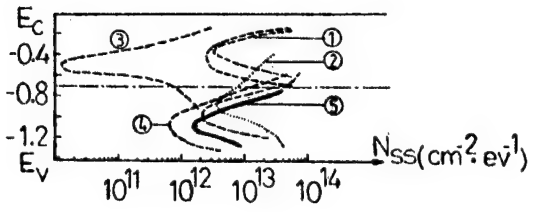

Figure 9. The interface state distribution in the energy gap. Comparison between the polysiloxane-nGaAs structures and various results reported in the literature.[11] Curves 1-4: Reference 11; curve 5: polysiloxane.

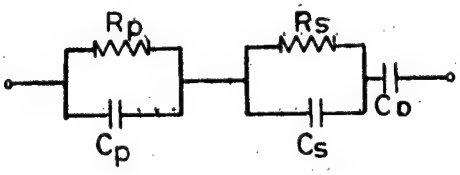

Figure 10. Equivalent circuit modelling the frequency dispersion of MIS capacitors.

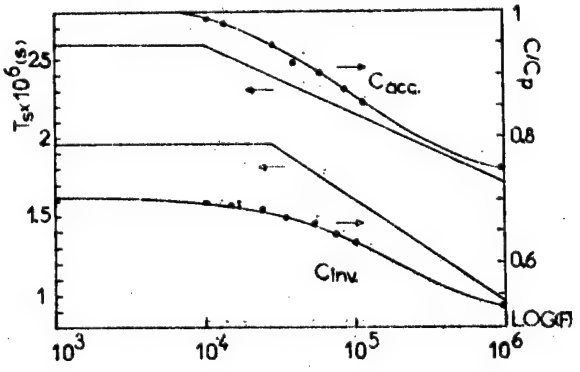

Figure 11. The capacitance, normalized by the low frequency limit, vs. frequency for accumulation and inversion: —— theoretical curve; ● experimental results.

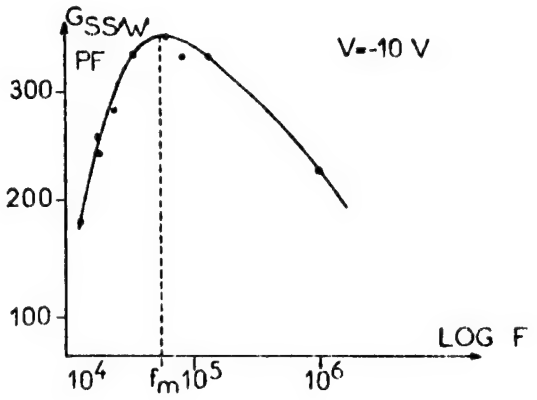

Figure 12. Frequency dependence of the conductance for an M-polysiloxane-nGaAs capacitor biased in inversion.

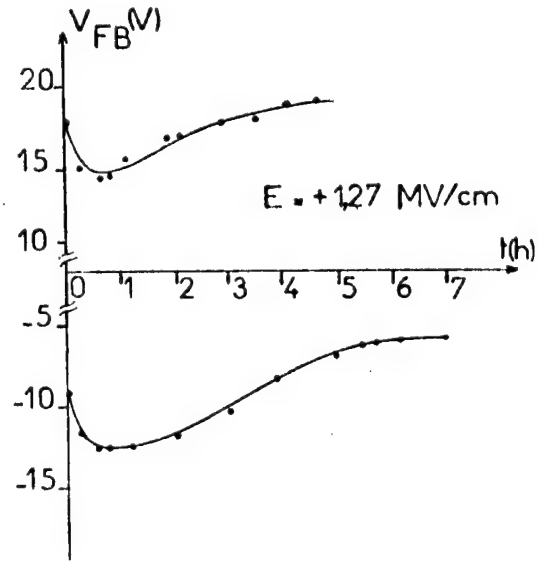

Figure 13. Shift of the C(V) curve under the effect of a field of 1.27×10^6 V/cm and 80 percent of relative humidity.

The curve shows a maximum corresponding to a pulse ω_m, with $\omega_m \times \tau_s = 1$, which gives the value of τ_s.

The curve was drawn (Figure 12) for a voltage equal to -10 V, which places the structure in an inverted state.

For voltages corresponding to the depletion mode, the curves representing $(G_{SS}/\omega) = f(\omega)$ are no longer symmetrical and no longer make it possible to determine τ_s; actually, this method is acceptable only for low densities of states.

The time constant of surface states, τ_s, was found to be equal to 2×10^{-6} s, but the width of the peak suggests the existence of a frequency dispersion of τ_s. Among the mechanisms responsible for this dispersion we can mention:

- tunnel-effect exchanges between the semiconductor and traps located in the insulator;

- variations of the surface potential due, on the one hand, to an energy distribution of the density of surface states and, on the other hand, to charges distributed throughout the insulator.

Knowing τ_s and ψ_s, we can obtain an estimate of the hole-capture cross-section. We found values of the order of a few 10^{-15} cm^2, which are those usually mentioned in the literature.[15,16]

5. Effect of Relative Humidity on the Characteristics of the Polymer and the GaAs Interface

5.1. Effect of Humidity on the Intrinsic Properties of the Polysiloxane

Polysiloxane films are deposited on a glass substrate, metallized with gold and placed in a test cell in which the relative rate of humidity can be adjusted to values of 20 percent, 48 percent and 80 percent.

An infrared spectroscopy analysis shows, through the variations of the peak corresponding to OH bonds, that the polysiloxane is sensitive to humidity rates of 80 percent and above. As far as permittivity is concerned, we could show that annealing for 1-1/2 hour in a nitrogen atmosphere would bring the variation rate of this parameter to a value of 2.6 percent for an exposure of 10 hours or so at a relative humidity of 80 percent.

5.2. Effect of Humidity on the Polysiloxane-GaAs Interface

For Au-P-GaAs and Au-P-Si structures, we did not observe any modification of the C(V) characteristics after prolonged exposure in an atmosphere with humidity rates of 20 percent and 48 percent.

With an 80-percent rate of humidity, with both types of structure, we could observe a translation of the C(V) curve toward positive voltages, corresponding to a negative charge variation at the interface of approximately 2×10^{11} charges cm^{-2}.

The structures were exposed to high humidity (80 percent) under a positive voltage stress inducing an electric field of the order of 10^6 V/cm.

The variations of the C(V) curves with time is shown on Figure 13. Note that the C(V) curves are shifted toward negative voltages when the stress is first applied; then the direction of shift is reversed.

The shift observed when a positive field is first applied reveals an increase in the number of positive charges at the interface, where the migration of negative charges leading to a decrease in the number of negative charges present at the interface [as published]. This is quite likely the migration of OH^- ions toward the metal electrode, so that the remaining charge localized near the semiconductor becomes more positive and causes the curves C(V) to shift toward negative voltages in a first stage.

We also note that the shift of the C(V) curves looks different; actually, the direction of shift is reversed. Several mechanisms can be assumed to account for the ascent of the curve:

- Humid air is obtained by bubbling air through a saturated solution of baryum chloride, BaCl. After exposure of the structures to the humid atmosphere, OH^- ions are present in the polymer, but we can also consider that positive Ba^{++} ions have penetrated the polysiloxane. When a positive voltage is applied, these positive charges will accumulate at the polymer-semiconductor interface. After part of the OH^- ions have migrated, electrons may be injected by the semiconductor and neutralize the positive charges, causing the ascent of the curve representing the shift of the C(V) curves, in the long-time mode.

- The second theory is that injection by the semiconductor takes place already when the positive bias is first applied, and the presence of Ba^{++} ions due to exposure to humidity is not considered. We must then consider that the time constant of the electron injection mechanism is smaller than that of OH^- ion migration through the polymer. This seems unlikely, as ionic charges have low mobility.

- The third possible mechanism involves an electron injection from the semiconductor in the long-time mode. This injection is made possible by the alteration of the barrier at the polymer-semiconductor interface, due to the migration of OH^- ions. Whereas OH^- ions can migrate toward the metal electrode, electrons are trapped and remain close to the interface.

In a humid atmosphere and under prolonged application of a positive electric field, the dominant process consists in a movement of OH^- ions, which does not increase the instability of the polymer. Actually, an OH^--ion compensation takes place, due to the exposure of the M-P-S structure to high humidity and to the positive ions existing in the polymer layer and inherent to the manufacturing process.

6. Conclusion

The insulator-GaAs interfaces have been the subject of many studies. They all bring out one remarkable fact: the GaAs surface remains relatively insensitive to the nature of the dielectric deposited.

In the light of these results, we approached the problem of GaAs passivation by preparing a dielectric layer obtained through cold-plasma deposition from a polysiloxane vapor.

- The growth rate of the layers deposited (1,000 Å/min) is of the same order as those observed during the formation of nitride or oxide type films.

- The electric properties of the dielectric film (leakage current < 10^{-10} Å, dielectric breakdown field of the order of 5 x 10^6 V/cm, ε_R = 2.5) make it an excellent insulator.

The fact that no current increase is observed before the breakdown occurs makes it in this respect a better insulator than nitride or oxide films.

- The adherence of the film deposited is excellent and withstands well high-amplitude thermal shocks.

- The electrical properties of the polysiloxane GaAs interface offer a performance comparable to the results generally observed with dielectric-GaAs systems. Even under 80-percent relative humidity, the C(V) shifts observed do not show any appreciable variation in the quantity of charges displaced.

Acknowledgment

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CSO: 3698/114

UK, FRG, FRANCE: R&D IN SENSORS, RELATED FIELDS

Stockholm UTLANDSRAPPORTER in Swedish No. 8402, Aug 84 pp 63-71, 78-88, 91-98

[Report by graduate engineer Thomas Jarne, Washington, graduate engineer Jan Hellsten, Bonn, graduate engineer Karl-Gunnar Nilsson, Paris and Dr Eng Dan Andree, London, and well as graduate engineer Michael Wang, Beijing: "Sensors"]

[Excerpts] Preface

Sensor technology is a field which is attracting more and more interest and attention. This was the reason why Sweden's Technical Attaches decided to make a concerted effort from their offices in Washington, Tokyo, Bonn, Paris and London, by simultaneous reports on the technology and marketing of sensors in each country. The result is presented in this report, which includes material from the United States, FRG, France and Great Britain, as well as a brief presentation of the situation in China. The Japanese material follows a somewhat different arrangement and will be published in a separate report series.

The arrangement of the original material for this compilation was in principle the same for all countries. It is our hope that such a collected survey will provide a better overview than separate country reports on the subject. For those who are interested, however, the original material from Washington, Bonn, Paris and London is available at the home office of Sweden's Technical Attaches.

The authors of the report are graduate engineers Thomas Jarne, Washington, Jan Hellsten, Bonn, and Karl-Gunnar Nilsson, Paris, and Dr Eng Dan Andree, London, as well as Graduate engineer Michael Wang, Beijing. Karl-Gunnar Nilsson has also compiled and edited the material.

III.1.2 Great Britain

The British state has an extensive program in the form of support for R & D through information technology (IT). By generalizing a little, it is possible to say that the Science and Engineering Research Council (SERC), administered by the Department of Education and Science (DES), is responsible for supporting research, while the Department of Trade and Industry is responsible for supporting development.

Great Britain is very far ahead in the sensor field, in particular in fiberoptics and fiberoptical transducers. An accelerating factor is the far-reaching plans for the introduction of cable television. The government has decided to start 11 pilot projects, each encompassing 100,000 subscribers. It is likely that most of the systems will use fiberoptics.

Department of Trade and Industry (DTI)

DTI has a "package" of programs for supporting the industry, called "Support for Innovation" (SFI). The purpose of this program is to

--increase the awareness of a new technology

--encourage the technology transfer between industry and academic institutions

--support the introduction of new technology

--support the development of new products.

The SFI offers this support for research and development of products up to and including the prototype stage. Support can be obtained for as much as one-third of the entire development costs. There are also a number of programs, some of which are

--Biotechnology
--CAD/CAM
--Flexible manufacturing systems
--Industrial robots
--Software development
--Microelectronics

In this connection the most important program is

--Fibre Optics and Opto Electronics Scheme (FOS).

FOS was initiated in July 1981, and at that time 25 million pounds were set aside for 5 years. In December 1982 another 15 million pounds were granted, that is to say a total of 40 million pounds. By May 1983, 34 million pounds had been utilized. The total effort (DTI + industry) is estimated at 167 million pounds.

The purpose of FOS is to

--build an industrial fiberoptics capacity (components, systems, cables, etc.)

--develop a broad spectrum of optoelectronic components

--encourage the use of fiberoptics and optoelectronics.

Special importance is attached to

--single-mode fiber technology

--semiconductor displays

--fiberoptical sensors.

In order further to support the development of fiberoptics and opto-electronics, JOERS (Joint Opto-Electronics Research Scheme) was initiated jointly by DTI and SERC (Science and Engineering Research Council).

Firms can obtain support for up to 50 percent of the total cost, while academic research receives 100 percent coverage. The objective is for the projects to be undertaken jointly by industry and universities.

Priority will be given to projects in: integrated optics and optoelectronics, fiberoptical components and systems, display technology, sensors, data storage and new materials.

The project is to run for 5 years and was begun in December 1982 with 15 million pounds (10 million from the DTI and 5 million from SERC).

Science and Engineering Research Council (SERC)

The SERC awards grants to universities, advanced schools and to its own research institutes. A number of committees exist within the SERC, and in this context Information Engineering Committee (IEC) is of primary interest. The IEC, in turn, is divided into three subcommittees: Computer and Communications, Control and Instrumentation and Solid State Devices.

The Solid State Devices Sub-Committee deals with JOERS, which was described in the previous section under DTI.

Within the Control and Instrumentation Sub-Committee there is a so-called Specialty Promoted Programme (SPP) for Instrumentation and Measurements. The program was initiated in 1976/77 and is expected to continue until fall 1984.

By July 1982, 1.6 million had been used. Allocation has been quite even; the 1981/82 budget was 454,000 pounds. The major part of the grants went for the establishment of four Measurement Centres.

Warwick is the largest of the four centers established. A Centre for Microengineering and Metrology has been built, which primarily works with applications of existing sensors. Most frequently used are opto-sensors, in connection with precision instruments. SERC granted 397,000 pounds to build this center.

Bradford is the next largest center, and it received 370,000 pounds. The activity consists of measuring the flow of "difficult" fluids.

City University of London has received 273,000 pounds and works with mathematical models for transducers, ultrasounds and inspection. Professor Bragnell has recently moved to University of Southampton, with the result that the activities may be somewhat "fluid."

UMIST has received 131,000 pounds and has specialized in various types of real-time measurements. See further under the University Research section (Chapter III.2.2.1--under the heading "The University of Manchester Institute of Science and Technology"--UMIST).

Of the total grant, 63 percent went to these four centers. Over the last few years the grants did not keep pace with inflation. The emphasis is on the following areas:

--Industrial Measurement Technique
--Basic Transducer Design
--System Design in On-line Plant Instrumentation
--Reliability and Maintenance

In general, the following should also be noted:

--microprocessors in "Instrumentation and Measurements"
--man-machine communication
--identification of new R & D fields for sensors, in which the new "cheap" electronics could be utilized.

Before the project began, SIRA Institute Ltd was asked to make a study of the demands which should be posed by industry. The conclusion was that the effort should be concentrated to: development of sensors (in particular remote), improvement of reliability and service of electro-optical components and fiberoptics.

Simultaneously with the SIRA study, Rutherford Appleton Laboratory (RAL) made a study of the activities in progress at universities and advanced schools. The conclusion was that greater efforts were needed in advanced measurement technology.

Within the Computing and Communications Sub-Committee there is a program for "Pattern Recognition and Image Processing." The focus of this project is, of course, on the application of sensors rather than development.

III.1.3 The FRG

Government R & D Support

In the FRG, government support for research and development takes place mainly through the Federal Ministry for Research and Technology (MMFT) and the major research institutes (Fraunhofer, DFVLR [German Research and Experimental Institute for Aeronautics and Astronautics]). The BMFT provides direct and indirect financial support for various projects. The research institutes

undertake both commissioned research work for individual companies and government-supported basic research.

The research conducted at universities and advanced schools receives direct project grants from the BMFT. These are obtained in a manner similar to STU's [Swedish Board for Technical Development] project support in Sweden. The research institutes also apply for direct project support from the BMFT.

A few examples of project support by the BMFT are given below.

User	Subject	Period	Grants in DM
Fraunhofer Gesellschaft Munich	Image processing improvement by numerical and structural methods	81-83	971,000
Fraunhofer Gesellschaft Karlsruhe	Fiber analysis	82-83	350,000
Fraunhofer Gesellschaft Munich/Karlsruhe	Combined image processing systems	83-85	4.5 million
Fraunhofer Gesellschaft Munich/Karlsruhe	Development and manufacture of silicon sensors	82-86	2.1 million
Battelle-Institut Frankfurt/Main	Sensors in thick-film technique	83-85	440,000
Fraunhofer Gesellschaft Munich/Freiburg	Fiberoptical sensors	81-84	2.97 million
Fraunhofer Gesellschaft Munich/Freiburg	D-field sensors with integrated electronics	83-85	587,000
Stuttgart University	Development of new thick- and thin film techniques for humidity measurement	80-83	330,000

In addition to support for advanced schools, universities and research institutions, a multitude of companies receive financial support from the BMFT for research and development of sensors.

The new FRG information technology program (1984-1988), totalling DM 3 billion, includes the following efforts, among others, in the sensor field:

--Special programs in microperiphery (sensors, among others)--DM 320 million.
--Development of new speech and image synthesis as well as pattern recognition--DM 360 million.

III.1.4 France

Government support for R & D in measurement technology is relatively modest. Measurement technology or sensors are not included as an individual project in the incentive programs adopted by the Industry and Research Ministry (MIR) for the electronics industry and the development of electronics in France.

Within the MIR's Scientific and Technical Mission (MST)--an advisory expert function--there is a "transducer committee," Comite Capteurs, with members from industry and research institutes, among others. It is this committee which controls the government efforts in the sensor field by identifying and giving priority to needs and thereafter proposing projects for the MIR sections DESTI, and, to some extent, DIELI (see the organization chart), as well as ANVAR (National Agency for the Evaluation of Research).

A large part of the support is given in the form of so-called "Concerted Actions," in which attempts are made to bring industry and research together through special cooperation projects between individual companies and research institutes. The committee requests proposals for such projects and then matches companies with suitable research institutions.

In the latest "action," seven principal subjects were indicated:

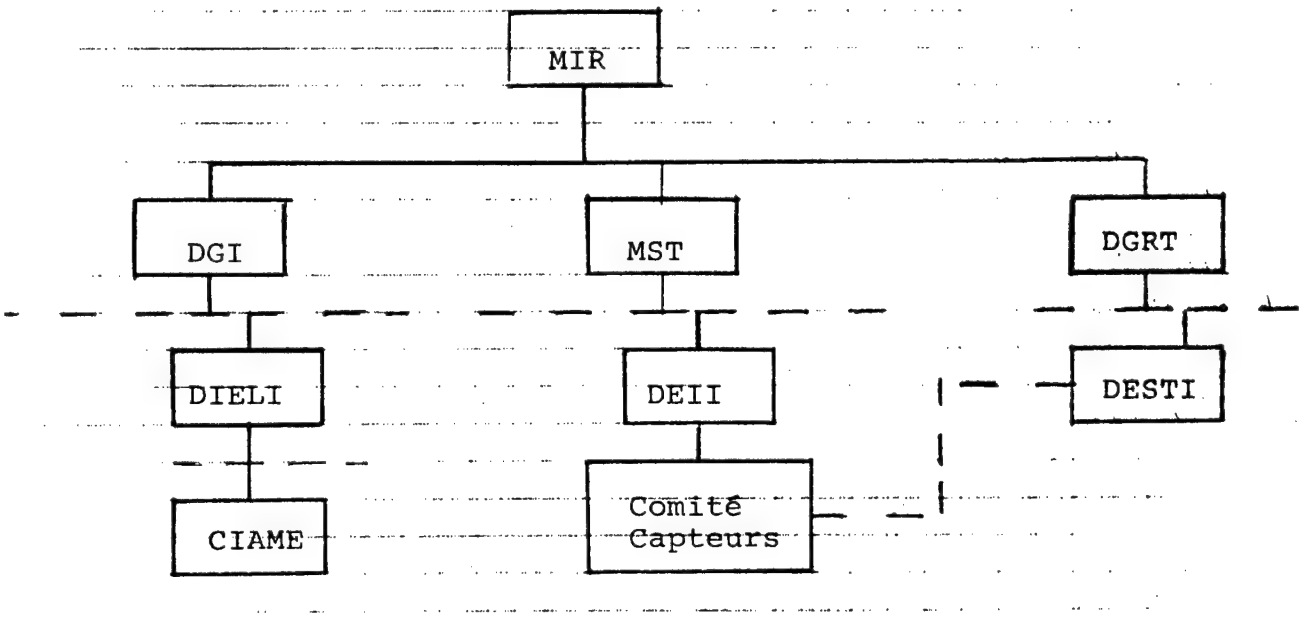
--Sensors for gas
--Fiberoptic sensors
--Sensors for the food and agricultural industry
--Electrochemical sensors
--Piezo- and pyroelectric sensors (in particular PVF_2 applications)
--Sensors for the textile and clothing industry.

An approximate budget for this action is 5-10 million francs. The previous action lasted for the period 1979-1982 and amounted to about 16 million francs.

Another organization which should be mentioned is CIAME--Industry Commission-Administration for Measurement, which belongs under DIELI but is composed of representatives of several ministries (industry, defense, universities etc.). It has been active since 1981, and its duty is to support the development of the French instrument industry in general. Its activity consists primarily of

--organizing exhibits inside and outside France
--issuing a catalog over French instrument and sensor manufacturers (included in the reference material)
--documenting and publishing evaluation methods for various types of measuring instruments
--undertaking market studies for various types of instruments and sensors (this documentation is only intended for domestic industry and administration and is therefore not available to Sweden's Technical Attaches).

What follows is an attempt at an organization chart over the previously mentioned authorities.



MIR: Ministry of Industry and Research

DGI: General Directorate of Industry

MST: Scientific and Technical Mission

DGRT: General Directorate of Research and Technology

DIELI: Directorate of Electronics and Information Industries

DESTI: Directorate of Scientific and Technological Development and Innovation

DEII: Department of Electronics, Information and Instrumentation

CIAME: Industry Commission-Administration for Measurement

[Comite Capteurs: Transducer Committee]

III.2 Research at Universities and Research Institutes

This section will provide a brief survey of the research in the sensor field which is not directly tied to industry. It is hoped that the examples and projects presented are the most current and interesting ones in the field.

III.2.2 Great Britain

III.2.2.1 The Universities

University College London (UCL)/University of Strathclyde, Glasgow

Since Professor Culshaw has recently moved from UCL to Strathclyde, it is uncertain what will happen to the research at UCL. At UCL Professor Culshaw headed the project

> "Interferometre Optical Systems"
> 1982-10-01--1985-09-30, with a
> budget of 64,000.

At Strathclyde Culshaw will establish a group around "Optical Fibre Instrumentation."

A few special fields are described below.

Optical Fiber Gyroscope

When allowing light to pass in both directions of a loop (550 meters long), the result is a delay due to rotation. The sensitivity is 0.01° per hour. Gyroscopes of this type have many advantages over traditional gyroscopes. Besides "ordinary" navigational applications, applications in the automobile industry are also noted.

Optical Fiber Sensor System

Systems are investigated, in which several different types of optical fiber sensors are connected to a communcations network. The applications of interest are in the area of control of real-time processes.

Optical Transducer Architecture

Work is under way with remote optical sensors for position finding, with particular view to the demands imposed by the engineering industry. A typical resolution is 1-5 mm. One also works with measurement of pressure, forces and sound.

Optical Components

Studies and research will be done on optical components which are part of optical systems. Both active and passive components will be investigated.

University of Southampton (119,000 pounds)

Department of Electronics, Prof J. E. Brignell

Microcomputer-based sensors are a specialty. The importance of including memory in sensors is stressed.

There is a special group--Transducer in Digital Instrumentation Research Group--which also publishes a NEWSLETTER.

A long-range project is under way for the purpose of reducing the long construction time for digital instruments by standardizing software and hardware interfacing.

Together with Ferranti Computer Systems, work is being done with semiconductor sensors.

Another group works with new materials for sensors: PVDF (Polyvinylidene Fluoride). This plastic material has both piezoelectrical and pyroelectrical properties.

Other projects are:

--Protocols for Data Transmission in Remote Sensor Systems

--Digital Interfaces for Transducers

--Transducer Compensation in Digital Instruments

School of Biochemical and Physiological Sciences

A group consisting of persons with biosensors is presently doing research. Dr C. R. Lowe heads the group. A summary of the work of the group is given in Appendix 1. The group is expanding and it is anticipated that it will number 12-15 persons during 1984.

University of Edinburgh

The Department of Electrical Engineering has grants totalling millions (pounds) for VLSI technology. It is difficult to provide any information on how much is intended just for sensors. In all likelihood, several tens of thousand of pounds are involved.

One project is titled "Microelectronics Ion-Sensors-Design Fabrication and Instrumentation," with a budget of 87,000 pounds for the period 1 June 1983 to 31 May 1986.

The traditional method for producing ISFET (Ion Sensitive Field Effect Transistor) is very costly. A new method has been developed, which is based on "thick-film-hybrid circuit," thus using a direct measurement method which gives good stability.

The University of Manchester Institute of Science and Technology (UMIST)

As we mentioned earlier, UMIST is one of the four centers formed with funds from the SERC. A Department of Instrumentation and Analytical Science (DIAS) has been created, and 135,000 pounds were obtained for its establishment. The main effort centers around industrial methods for chemical analysis. DIAS has a total grant amount (from SERC and industry) of 500,000 pounds a year.

A great deal of work is done with pressure sensors of various kinds. New materials, such as polyvinylidene fluoride and other types of "piezoelectric sensors," are also used.

From 20 to 22 September 1983 the "European Conference: Sensors and Their Applications" was held at UMIST.

The conference was arranged by the Institute of Physics in cooperation with the IEE, among others. There were 270 participants, over 50 percent of whom came from industry.

The reference material lists PHYSICS BULLETIN (August 1983) and SCIENTIFIC INSTRUMENTS (October 1983), in which "Invited Papers" are included. The conference program with abstracts of all the papers is also listed. Only a few of the papers are covered here; information is given about the newly formed ISAT group.

The University of Newcastle upon Tyne

Work is being done with ISFET (ChemFET). One project is titled "Microelectronic Chemical Sensors for Clinical Analysis of Blood Electrolyte Cations." This work is conducted at the Department of Physical Chemistry.

At the Department of Electrical and Electronic Engineering, a small project is under way with the title "Integrated Silicon Sensor for Temperature and other Measurements."

University of Cambridge

At the Department of Chemical Engineering there is a special Biotechnology Unit. Dr C. R. Lowe recently moved to Cambridge from Southampton. Dr Lowe, together with about 10 researchers, will work with biosensors.

The University College of Wales

No major contributions are made in the field of biosensors. Dr D. B. Kell has worked with "The Role of Ion-Selective Electrodes in Microbial Process Control."

Dr J. D. R. Thomas from UWIST (University of Wales Institute of Science and Technology, Cardiff) was the editor of an issue of ION-SELECTIVE ELECTRODE REVIEWS (Vol 4, No 1 1982), which also contains the article by Dr Kell.

Cranfield Institute of Technology

Work is done jointly with Oxford University and Imperial College, London. It is estimated that a total of 25 persons work in the field of biosensors.

Recently, eight patents were granted. The following areas/projects are in progress:

--Glucose sensors
--Bioelectrochemical fuel cell and sensor based on a quinoprotein, alcohol dehydrogenase
--Application of electron transfer between biological systems and electrodes.

University of Kent

A great deal of work is done with fiber sensors.

There is a large project, among others: "Application of Lasers and Fibre Optics to a new Generation of Sensors." The project period runs from 1 December 1981 to 30 April 1984 and the budget is 60,000 pounds.

"Fibre Optic Laser Doppler Velocimetry" is used to determine the velocity of macroscopic objects and fluids. The dynamic range is 10^{-6} - 10^{5} m/s!

Another project develops fiber interferometers. These can be used for measuring temperature, acceleration and acoustical pressure and magnetic force.

III.2.2.2 Research Institutes and Organizations

Atomic Energy Research Establishment

Ultrasound sensors are being developed for application in the processing industry in order to save energy. The magnitudes which can be measured are fluid level, concentration or density, fluid speed and temperature, among others. Also, methods (IR) for studying reactions inside combustion engines are used.

Agricultural Research Council (ARC)

The council itself does not develop sensors, but there is a great need for sensors in agriculture, the food industry, etc. The reference material includes a report from the ARC, in which the demands and requirements are reported. The report is primarily aimed at researchers and manufacturers.

In general it can be said that there is a need for small, robust sensors with digital data output, which can be connected to a data logger. A few of the types of sensors needed are for measuring temperature, air humidity, water and chemical content in the ground, pressure, hormone concentration, etc.

The report includes a list of the types of sensors used today.

National Physical Laboratory (NPL)

NPL is one of the research institutes under the Department of Trade and Industry. A great deal of work is done on standardization of measurement methods.

The sensor research deals largely with optical sensors. Examples of projects are:

--NPL miniature monochromators for use in optical-fiber sensors

--Optical probes--surface measurements

--NPL/NMI absolute linear encoder--incremental measurements in "difficult" environments (NMI = National Maritime Institute

--NPL launches a program on measurement standards for fiber optics.

--Optical radiation measurement: detectors.

Firms and organizations can turn to the NPL for consultations, calibration, etc.

The NPL has further undertaken a study of the optical sensor market. The report contains approximately 100 products with names of companies, etc. The report can be ordered through the London office of Sweden's Technical Attaches (25 pounds).

Battelle Institute Ltd.

With over 7,300 employees, Battelle is one of the world's largest research institutions. It has offices all over the world, with centers in Geneva, Washington and Frankfurt. Regional offices are located in London and Stockholm, among other places.

The Geneva office recently concluded a survey of the sensor market: "Optical Fibre Sensors and Instrumentation." The result has become three volumes totalling more than 1,500 pages. The first part includes R & D at companies, universities, laboratories, etc., with more than 600 references. Volume two contains, among other things, commercially available sensors with a list of over 300 companies in Europe and the United States. Volume three contains the corresponding information for Japan.

The reference material lists a document which has detailed information about this report, such as the table of contents for volumes one and two, examples of typical data, etc.

ERA Technology

ERA is a trade organization within the electrotechnology. A study was recently initiated, which is to result in a report: "Fibre Optic Sensors, Market Opportunities and Technology Trends to 1990."

Fiberoptic sensors will play a very significant role in the 1990's. The total sensor market is estimated at 5 billion pounds today.

Today, a great deal of progress has already been made. There are temperature transducers for the -50° to +250° C range, changes can be recorded with 25 nm resolution and speed with 1 m/s resolution.

SIRA Ltd

SIRA is a trade organization in the instrument and measurement industry. It has about 100 members, consisting of both manufacturers and users.

The OSCA-UK Optical Sensors Collaborative Association has been started, in cooperation with the Department of Trade and Industry. The objective is to stimulate new development in the field of optical sensors.

Central Electricity Generating Board (CEGB)

A system has been developed for: "Optical Fibre Current Measurement." Current intensity is measured by utilizing the fact that light changes polarity when passing through an electrical field.

Other types of sensors are:

--Microbend Displacement Transducer

--Moving Fiber Displacement Sensor

--Differential Absorption Temperature Transducer

By measuring reflected intensity, it is possible to determine increments and temperature.

ISAT--A New Institute Group

A new group has been formed: Instrument Science and Technology Group (ISAT). ISAT is intended to be a forum for discussions concerning the physical principles on which measurement instruments and measurement systems are based. Initially, the focus will be on industrial applications of new sensor types.

The first meeting was held on 23 January 1984.

III.2.3 The FRG

Fraunhofer-Institut fuer Physikalische Messtechnik [Fraunhofer Institute for Physical Measurement Technique]

This institute does research with sensors for shifts in potential, in particular for machine tools.

Fraunhofer-Institut fuer Produktionstechnik und Automatisierung (IPA) [Fraunhofer Institute for Production Technique and Automation]

Works with power sensors for robots, for example, in applications such as tactile sensors. Optical sensors are also developed.

Fraunhofer-Institut fuer Informations- und Datenverarbeitung (IITB) [Fraunhofer Institute for Information and Data Processing]

Research on optical visual systems and sensors for positioning.

Deutsche Forschungs- und Versuchsanstalt fuer Luft und Raumfahrt (DFVLR)

Works primarily with power and torque sensors, primarily for industrial robots. Also inductive distance sensors and laser applications.

Fraunhofer-Institut fuer Festkoerper-Technologie [Fraunhofer Institute for Solid State Technology]

Develops semiconductor sensors for the measurement of pressure, temperature, flow and gas detection.

Battelle-Institute E V

Works with semiconductor sensors for light, humidity, radiation, power and gas, among others.

III.2.4 France

The sensor research conducted at universities and advanced schools is relatively difficult to analyze. What is often involved is primarily material research, where one of the applications is some type of sensor. As an example can be mentioned the university in Bordeaux, which works with fiberoptic position sensors, among others. Various departments of the technical institute in Grenoble also do work in the sensor field.

A large part of the university research is tied to CNRS--the National Center for Scientific Research. The CNRS also has its own laboratories.

A brief presentation of the research institutions of greatest interest to the sensor field follows below. A more thorough review of the projects described is contained in the reference material.

LETI--Laboratory for Electronics and Data Processing

Belongs to the CEA--Atomic Energy Commission--and is located in Grenoble. Half of the total of 600 employees at LETI belongs to the component section. Only 12 persons are occupied with pure sensor research, but results from other sections are naturally used in the sensor research. Among the sensors produced, the following may be mentioned:

--A fiberoptic current sensor, which uses the polarization change which occurs in light in optical fibers, located in the magnetic field. Its measurement range is 7-2,000 A from peak to peak, 0-10 kMz. The temperature range in operation is -20° C to +60° C. The sensor was developed in cooperation with the firm of Merlin-Gerin.

--A gamma spectrometer, with semiconductor analyzer of cadmium telluride--CdTe.

--SQVID--Superconducting Quantum Interference Device--for detection of weak magnetic fields.

--A capacitive hygrometer, in which the water-absorbing dielectric is a polymer (cellulose acetate), where the water permeates through a porous chrome electrode. Licensed manufacture by the firm of Coreci in Lyon.

--Strain gauges, produced in thin-film technique, used in electrical bathroom scales from the Terraillon company in Annemasse.

--ISFET--Ion Sensitive Field Effect Transistor.

Obviously, quite a varied selection.

ONERA--National Office for Aerospace Study and Research

ONERA belongs under the Ministry of Defense and, more precisely, under the DRET--Directorate for Armament Research, Study and Techniques. Its research is primarily aimed at air and space technology.

A few projects in measurement technology undertaken at NERA's facility in Chatileon:

--Capacitive distance transducers--in principle, the measurement object forms one of the electrodes in a capacitor, the sensor the other. The capacitance between the two electrodes gives a measure of the distance between them.

--"Ultrathin" sensors of various kinds. The basic principle is that the metallic parts of the sensors are deposited onto thin plastic substrates (Kapton from Dupont de Nemours). Depending on the measuring magnitude, one or more layers of such substrates are then used. Four types of sensors have been produced with this technique: pressure, temperature, temperature flow as well as a type of analysis of the turbulent boundary layer along a body in an air stream. The thickness of the sensors does not exceed 80 μm.

At ONERA-CERT--Toulouse Center for Study and Research--work is under way with, among other things, measurement of gas flow and measuring methods for determining the density of gases.

CETIM--Technical Center for the Mechanics Industries

Undertakes commissioned research for, and together with, industrial companies. One such result is a measurement transducer intended for measuring the thickness of the oil film in a sliding bearing, specially intended for diesel engines. The sensor is mounted in the bearing bushing, and the thickness of the oil film can be measured on the basis of the reluctance change detected. Other projects are special sensors for acoustical emission for underwater tests and strain gauges.

LAAS--Laboratory for Automation and Systems Analysis

One of the CNRS' own laboratories. Its development of "artificial skin," that is to say a tactile sensor, has attracted a certain amount of attention. It may be briefly described as a bottom plate with an electrically conducting surface, on which is placed a soft rubber mat, supplied with small dot-shaped electrodes all along the surface. When this surface is deformed, for example by placing an object onto it, the "skin" supplies information, partly about the coordinates for the deformation, and partly about the magnitude of the pressure applied to the "skin" at these points. This "skin" may become commercially available in 3 to 4 years.

LAAS also works with visual systems for robots. One system is based on interaction between a CCD camera and a laser. Based on the camera picture, a number of points are determined, the distance to which is measured by means of the laser. In this manner three-dimensional information is obtained about an object, without having to sweep the entire object with the laser.

LCR--Central Research Laboratory

LCR is Thomson-CSF's central research laboratory. It also accepts commission work from other customers. As examples of LCR's projects may be mentioned various types of sensors (accelerometer, pressure, sonars ...), based on synthetic piezoelectrical polymers, primarily PVF_2--vinylidene polyfluoride--and fiberoptic gyroscopes.

Two other projects are gas sensors in semiconductor technique and an optical magnetic field sensor.

CENG--Grenoble Center for Nuclear Studies

Belongs to the CEA--Atomic Energy Commission. Works with various sensor technologies, primarily intended for nuclear power applications. As examples may be mentioned temperature measurement with optical fibers and a sapphire probe for detecting phase boundaries in two-phase fluid-gas systems.

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MM = MACHINE MODERNE
M = MESURES
EA = ELECTRONIQUE ACTUALITES
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TR = TEMPS REEL

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  INSPEC

The most important persons interviewed:

- Marc Des Jardins, EXERA, chairman of Comite Capteurs

- Philippe Gabet, SYNAME

- Gilles Delapierre, LETI, groupe capteurs

11949
CSO: 3698/72

SCIENTIFIC AND INDUSTRIAL POLICY

RESEARCH, TECHNOLOGY PARKS SPRING UP ALL OVER FRG

Munich INDUSTRIEMAGAZIN in German 15 Sep 84 pp 186, 189

> /Text/ Technology parks and basic research promotion centers are the big hit of the season. INDUSTRIEMAGAZIN has taken six selected examples to show what the new projects of the industry promoters can offer and for which business operators they are suited as company headquarters.

BIG /Berlin Innovation and Basic Research Promotion Center/ is in. The Berlin Innovation and Basic Research Promotion Center on the grounds of the former AEG /General Electric Company/ compound on Acker Street is considered the big showpiece of a new wave. At this time it already houses 15 young business operators within its walls. New applications come in almost daily: From former scientists from the nearby university or from foreign managers of big electronics corporations who are trying to be successful on their own.

As in Berlin, similar projects are mushrooming elsewhere: Research parks, technology centers, basic research promotion yards, or whatever the new locomotives of government, community, or regional industry promoters might wish to call themselves.

The Fraunhofer Institute of Systems Engineering and Innovation Promotion in Karlsruhe figured out that at least 50 such centers have been established at this time between Koblenz and Kiel--most of them of course exist only on paper (see also INDUSTRIEMAGAZIN report entitled "Industrial Settlement as of June 1984").

The licensing conditions however are not the same everywhere. Something that is supposed to be a research park as a rule wants to be only an interface between science and industry. That is where development work can be done, but no production.

Technology centers are less elitist. What is wanted here are "high-tech-type" research promotion outfits that will develop their idea up to the zero series. They are supposed to evacuate their place at the latest after the first few successes on the market.

Basic research promotion centers are least restrictive in their selection. They offer room and support facilities for every young business operator. More so than research and technology parks (which frequently are completely subsidized), basic research promotion centers in the final analysis want to earn a profit.

Contact Places for New Ideas--the Supply of Technology and Basic Research Promotion Centers

Berlin--BIG

Target Group

Technology-oriented enterprises; business operators are to have scientific or comparable qualifications; enterprise should not be older than 2 years.

Capacity

Surface area around 3,000 m^2 for about 10-15 enterprises (already fully occupied); expansion to 5,000 m^2 for another ten enterprises this year; also planned: Humboldhain research park in immediate vicinity of BIG.

Supply

Plant premises; shared facilities; office and conference center with telephone service, clerical staff for bookkeeping and other administrative activities, communications equipment (Telefax, etc.), procurement of advisors, contacts with scientific installations.

Conditions

Rental (including heat): DM6.80/m^2/month; general expense fee: DM300 per staff member per month; services are calculated separately; lease contract limited to 3 years with two-time extension possibility.

Contact Address

TU-transfer, Fasanenstrasse 4, 1000 Berlin 12, (0 30) 3 14 39 06, 3 14 51 31.

Start

30 November 1983.

Aachen--Multipurpose Work Center for Innovative Basic Research Promoters

Target Group

Technology-oriented basic research promoters from the science and crafts sectors and from the services.

Capacity

Surface area around 3,500 m^2 for around 30-40 enterprises (so far, seven enterprises have moved in).

Supply

Office, laboratory, and workshop facilities; shared facilities: Office and conference center with telephone and clerical staff, communications equipment (Telefax, etc.), support for loan and risk financing (risk capital exchange), contacts with scientific institutions.

Conditions

Rental (including secondary costs): DM8.50/m^2/month; fee for shared facilities: DM600 per month; lease is limited to 3 years; it is planned that the enterprises however will in any case move out after successful entry into the market; the young business operators must furthermore pledge to establish themselves thereafter in the Aachen area; special offers for basic research promotion financing available at the center.

Contact Address

AGIT, Aachener Gesellschaft fuer Innovation und Technologie-Transfer mbH, Theaterstrasse 6-8, 5100 Aachen (02 41) 80 40 23.

Start

June 1984

Karlsruhe--Karlsruhe Technology Factory

Target Group

Basic research promoters from the new technology sector (preferably microelectronics, robot engineering, and data processing).

Capacity

Surface area around 5,000 m^2; a maximum of 200 m^2 are available for each enterprise; so far, 16 enterprises have an option for a lease contract.

Supply

Plant premises; shared facilities: Reception room with telephone, conference rooms; services provided by Chamber of Industry and Commerce, experience exchange circles, contacts with scientific institutions.

Conditions

Rental: DM3/m^2/month, amount of secondary costs not yet firm; after 3 years, rental goes up to DM6.50/m^2/month; lease contract limited to 5 years; 1-year extension possible.

Contact Address

IHK Unternehmens-und Technologieberatung Karlsruhe GmbH, Lammstrasse 15/17, 7500 Karlsruhe 1, (07 21) 17 40.

Start

July 1984

Hildesheim--Hildesheim Technology Center

Target Group

Basic research promoters and young business operators (preferably from the control, measurement, and regulating equipment sectors).

Capacity

Surface area around 6,700 m^2 for about 30 enterprises; 50-230 m^2 available per enterprise; so far 30 options for lease contracts concluded.

Supply

Plant premises; shared facilities: Office and conference center with clerical staff and telephone, EDP system, integrated service enterprises (bank, workshops), communications equipment, contacts with scientific institutes.

Conditions

Rental DM3/m^2/month plus DM1 fee for shared costs; no time limit on lease contracts but rent rises to locally customary level after some time.

Contact Address

Stadt Hildesheim, Stadtdirektor Walter Hoffmann, Rathaus, 3200 Hildesheim 1, (0 51 21) 30 12 41.

Start

Autumn 1984

Syke--Syke Technology Park

Target Group

Target group not defined in any greater detail (applications so far from new technology sector).

Capacity

Surface area around 2,000 m^2 for 10-12 enterprises (center is in midst of industrial area).

Supply

Plant premises; shared facilities: Office and conference center with clerical staff and telephone, communications equipment, consultation available, contacts with scientific institutions.

Conditions

Rental DM2.50/m^2/month, cold /no heat/; all other costs are billed according to actual consumption figures; lease contracts to be signed initially for 3 years; extension possible for a maximum of 2 years.

Contact Address

Technologiepark Syke GmbH, Herrlichkeit 6, 2808 Syke, (0 42 42) 1 64 12.

Start

End 1984

Kassel--Kassel-Bettenhausen Enterprise Park

Target Group

Basic research promoters and small enterprises of all kinds.

Capacity

Around 160,000 m^2; production rooms are offered in sizes from 15 to 1,500 m^2; office space from 10 m^2 on up.

Supply

Office and production rooms; shared facilities: Office and conference center with telephone and clerical support; communications equipment (teletex, copying equipment, etc.); business consultation (feasibility studies, market studies, financing plans, etc.); also planned: EDP system, laboratory and storage rooms for temporary use by tenants.

Conditions

Room rentals customary on market (currently averaging DM6, cold /no heat/), depending on equipment of rooms; very short occupation times possible (1 month); no time limit on lease contracts regarding duration of lease; services to be billed in accordance with use.

Contact Address

Job Creation Ltd., Unternehmenspark Kassel, Lilienthalstrasse 7 - 25, 3500 Kassel-Bettenhausen, (05 61) 5 09 51.

Start
May 1984

5058
CSO: 3698/82

FRENCH RESEARCH MINISTER ON GOALS, PROGRESS, FUTURE PLANS

Paris L'UNITE in French 19 Oct 84 pp 11-12

[Interview with Research and Technology Minister Hubert Curien, who is the former head of the CNES [National Center for Space Studies], by Pierre-Yves Poindron; time and location of interview not specified]

> [Text] Research is in good hands. Hubert Curien, minister of Research and Technology and former head of the CNES knows what he wants and makes his wants known. The course is being maintained; it involves seeing to it that France holds its place in research and also in the world economy, and if possible to gain some positions in economically strategic sectors.
>
> But Hubert Curien knows that, to gain, he has to start on time. No question then of spreading himself too thin; choices are required. Those choices will not be made at the expense of basic research, on that the minister is definite, but research is also expected to spread in industry. After all, the economic and social repercussions of research are the surest way of making it known to the public. The time of the ivory tower is past. That a researcher is saying it gives more weight to the evidence. Hubert Curien makes his optimism fit the face of reality. There is knowledge and know-how nearly everywhere in the Hexagon and now it must be made known. Contrary to what some well-intentioned people abroad are thinking, France is not just the country of wine and haute couture, it can be the country of computers and biotechnology. As for Europe, research is a good way to make it go forward.

L'UNITE: What is the meaning of the return to a Research and Technology Ministry, which is independent and fully functioning?

Hubert Curien: It's absolutely clear. It is an expression of the will of the government as expounded by Laurent Fabius in his report to Parliament and in various public speeches, to modernize the country, as well as the idea that one cannot modernize unless one has a living science and an effective technology.

[Question] We are on the eve of 1985. The orientation and planning law that was introduced by the government and passed in 1982, provided for bringing the national research effort to 2.5 percent of the GDP [Gross Domestic Product], increasing the civilian Technological Research and Development budget by 17.8 percent per year in volume and increasing the number of workers in that field by 4.5 percent per year. Will those three objectives be attained next year?

[Answer] No. Let's say very clearly, they will not be attained. However, it must be said that they were defined before the appearance of the orientation law in 1981, in a world economic context that was different from the one we are experiencing today. With the evolution of the world economy that we have known since then, it has not been possible to maintain the effort that seemed to us to be possible that year. However, the figures that were drawn up then were--in my opinion--extremely useful, because they indicated the desire to make a more sustained effort in research than in other fields. We have not reached 2.5 percent of the GDP, but we are not impoverished. We are at 2.22 percent of the GDP.

[Question] The civilian budget, military budget and business budget combined?

[Answer] Yes. But don't forget that we started from much lower. We have got back on our feet. The number of research personnel is going to increase by 3 percent, which is not at all, not all negligible, at a time when, by the way, jobs paid by the state are rather diminishing everywhere. Thus, the figures announced in 1981, though they aren't satisfactory to the letter, are consistent in spirit, because research has been going through a new expansion since 1981.

[Question] The orientation law proposed a number of qualitative objectives. Basic research was to be "protected". Research was to "satisfy the social, industrial and cultural needs", in other words, to be open to industry and disseminate its knowledge to the public. There was also talk of training by and for research. What is the status today of the transformation of the research structures that were to be improved?

[Answer] With regard to the texts that regulate organisms and fix the status of personnel, we are practically at the end of the process set by the orientation law. Most of the organisms already have their new status. For those having to do with personnel, I have asked my collaborators to see to it in some way that the last points in abeyance be negotiated with the other ministries and arbitrated definitively. These statutes have been discussed with the social partners, for the last year in particular. All the questions that raise problems have been brought up and it is true that some of them are difficult, especially the question of the methods of the board of examiners for admission to the CNRS [National Center for Scientific Research]; it is not a very simple matter to harmonize a "normal" status as civil servant with practices that, for all that, are quite commendable in operation in those large organisms. We now have to move fast to emerge from all these institutional aspects and basically get down to the programs.

The second aspect: has progress been made toward better effectiveness? Effectiveness in basic research first: you have said that it is protected; it will no longer be possible to finance big technologic or applied programs. We are really careful not to do that. For applied research, we are orienting

ourselves toward programs that are clearly defined and offer industrial outlets.

Researchers--as you well know--no longer have an ethereal idea of research. They are not indifferent to the applications of their work. And they are doing everything in their power to see that it goes well. In that area, I find that we have made great progress. Without upsetting the completely natural sensibilities of the researchers. Some organize their research plans in terms of applications, others in terms of deepening their knowledge. Each of the two kinds of progress is as noble as the other. As useful.

[Question] You are preparing the follow-up to the orientation and planning law. Can you divulge the broad outlines for us?

[Answer] The broad outlines haven't yet been defined, because all the consultations are not yet finished. We went ahead with an initial sorting out, to see what forms should be given to the follow-up to the LOP [orientation and planning law]. Should we prepare a law, engage in a parliamentary debate after a vote, do something that gets closer to planning the whole of the national economy, should we make a planning law or an orientation law? We proceeded with a systematic inventory of all these possibilities and we are consulting all the partners concerned; we are awaiting the report of Mr Lions, who was assigned a mission by Laurent Fabius. Next, consultations of two kinds will be engaged in. The first with the Higher Research and Technology Council.

That Council, which is attached to this ministry, is representative of all the national components of research, researchers, trade union representations, industry, etc. All aspects of research are well represented there. Next, Mr Fabius wants me--and I am very happy that he did this--to put myself in direct relationship with all the political organizations, to ask them for their views on the future of science in our country and how we should carry on the effort defined by the first orientation law. All of this is now under way. A debate may be organized in Parliament at the end of the spring session or the beginning of the fall session in 1985.

[Question] What do you consider to be the assets of French research, its leading fields, those in which an effort would make it possible to make up for the delay, those in which we are lagging behind?

[Answer] I will not make an award list. But there are sectors in which French research has always been at the forefront, French biology has its champions, medicine, physics and chemistry as well. But I realize that you draw up the list of all sciences. I don't see any field of basic research in which France can't be said to possess at least a few very good elements.

On the applied research side, there, too, we have excellent elements, but there is a welter of possible subjects; if one wants to succeed, one must concentrate one's efforts. We have a great chance in the biotechnology field, because up the line we have good research and because down the line, industries are all ready to make serious efforts. Things are getting under way.

Likewise, in electronics and data processing, never believe that our chances are not good. Simply, we have to make an effort at definition, we have to

concentrate on a certain number of products and we have to go all the way with the programs we are mounting. I have no reason to be pessimistic about these two key fields. Nor any more, about equipment. I know of firms in iron and steel (I have seen products that perform extremely well) as well as in ceramics, which are a long way from lagging behind.

But mind you, you can't do everything and if one were trying to do everything, one would fail. There are no fields in which we have no chance, but in every one of them, we have to try to be up-to-date on products that offer outlets.

[Question] Some mobilizing programs have been revised downward in the 1985 budget. This is true of the "energy" program or the one for "development of the industrial fabric". Why these revisions?

The impetus for them was less strong than for others, it's true, but not at all because we considered the energy savings were no longer necessary. But after a necessarily costly start, we can maintain a good activity level with a reduced government budget, whereas in other sectors we have to increase our efforts. Electronics, data processing for example. It's really imperative, with extremely difficult partners.

[Question] Do you think the objectives proposed 3 years ago, of bringing France up to third place in electronics and somehow having it take 10 percent of the biotechnology market, have any chance of being realized? Doesn't that seem ambitious to you?

[Answer] Yes. It is ambitious, but it doesn't seem to me to be out of reach. Biotechnology is a very vast world that goes from medicines to agrofood products. There again, you can't do everything, but the small and medium-sized businesses have been made aware of the necessity of innovating and having people who are interested in research in immediate contact with the producer or manufacturer. We're moving forward.

In electronics, the state is making a significant effort, divided among several ministries, the PTT [Postal Telephone and Telegraph], Industry, Research and Technology. That effort has to bear fruit. We must, in software, where we have a very good reputation, or in equipment, come out with products that perform. But there again, I am not one of those who think we can cover the whole gamut of products.

[Question] France is being outdistanced by Japan in that field, while this country hasn't made any essential discoveries in 20 years. It's a little maddening to see that some are discovering and others are producing.

[Answer] Yes. We really have to think over our research policy, but also our industrial policy, because it isn't only the former that counts; we have to define a range of products that will be innovative and not too expensive at one and the same time.

[Question] One thousand five hundred firms say they are doing research. After some progress in 1982, their effort ran down. What do you expect to do to help them increase it: encouragement to invest, price policy, aid?

[Answer] Price policy is basically regulated by competition. If a price policy is decided upon and the Japanese or American competition offers finished products at lower prices, we won't hold to it. If someone wants to sell satellites, they can't be more expensive than the American satellites, and that isn't easy. If we aren't careful, we start too slowly, and those who have taken the lead charge lower prices. Then, obviously, industry must be able to put more money into research. It is not yet putting enough. I'm not instituting proceedings against manufacturers, who have obvious concerns. But if one wants to advance, if one doesn't want to let oneself be invaded by Japanese and American products or other products, still more research has to be done and industrial products must be more up-to-date.

Easier said than done. But it is inconceivable that all the money necessary for the research effort should come from the state. That's impossible and it isn't within the state's province. We have to conceive, with the manufacturers and financial organisms, of methods that draw off a little more ready cash in the direction of industries. And that must not correspond specifically to the indebtedness of the manufacturers, but it must really be participation money. We are in the process of studying this with various persons who really know the process of distribution of savings, in France as well as abroad.

[Question] Do you think the national firms have kept their promises in the research field? Have they played the pilot's role that was expected of them?

[Answer] Yes. The national firms have really done their duty. Which doesn't mean, however, that the others haven't done theirs. But really, the national firms have felt a special responsibility.

[Question] Some researchers are complaining of the division that now exists between the CNRS and the University, since the CNRS reform, at a time when there is talk of disseminating knowledge. What do you think about this?

[Answer] Perhaps they mean that under the old statute, academicians were more systematically involved in the evaluation proceedings of the CNRS. This is true, to a certain extent. But what I would very strongly set myself up against is a divorce between the CNRS and the University. That would be the worst blunder. All of the university laboratories draw a significant part of their support from the CNRS or the INSERM [expansion unknown]; and, reciprocally, the University is the source of researchers. One must understand that. It is unthinkable that a research organism like the CNRS or the INSERM would not live in direct contact with the University. On the other hand, most academicians have a vocation as researchers and are excellent researchers. The CNRS directors are aware of it. It would not be right to interpret certain aspects of the statute as a division. That would be a very bad interpretation.

[Question] Do you believe the University and the large schools can furnish the high-level researchers needed by the research organisms?

[Answer] Yes, in nearly all sectors. There may be some in which there is no training in the French tradition and in which there is a lack of specialists to train the young people. In such a case, I don't hesitate to say that we absolutely have to invite foreign colleagues for a few years. But, in a general

way, the French University has the capability of training the young generations. Maybe there are fields in which the influx is inadequate or too heavy. The reform that is presently in gestation on the graduate schools is going to take that into account, I am sure of it. But, even in the sectors that are farthest from application, high-level teaching must be maintained where a grand tradition exists. Nevertheless, you also have to think about prospects for the students.

[Question] The French don't know much about their research.

[Answer] Not much yet. We have an effort to make and that, too, is this ministry's responsibility.

[Question] Doesn't the mission that is incumbent on research, to help the country emerge from the crisis, finally risk favoring certain sectors at the expense of basic research or the human and social sciences?

[Answer] Basic research we are protecting, which doesn't mean that we are making it grow faster than applied research, but we are not going to draw from basic research, as if from a quarry, the bricks we might lack to mount industrial research. The prime minister is perfectly aware of that.

As far as the social sciences are concerned, I'll give you a concrete example. We decided to place in the organisms for technologic reflection and deciding on big mobilizing programs, someone from the social sciences, who would be its "conscience" in a way, and who would contribute the economic and sociological component to it. We would like the social sciences to be a part of the real life of the nation.

[Question] There is a research policy, affirmed by the government. But shouldn't there be research on policy? What contribution can science and technology give to the debate on ideas? Of what cultural project can they be the bearers?

[Answer] It's an interesting question, but the answer isn't easy. It would certainly be stupid to neglect that aspect. When you speak of the study of policy, I think of economic research, because that is the basis of political decisions. We are trying to see to it that research in this field is more and more solid.

[Question] I was also thinking of another aspect of the question. Let's take the example of the old debate on the acquired and the innate, a debate that doesn't make all that much sense and which genetics may clarify in quite a different way. Aren't there other fields in which science could aid in the debate on ideas?

[Answer] Ethical questions. Medicine and biology interest us; they are in danger of changing life in a few years. The government has given itself an ethics committee chaired by Professor Jean Bernard. There too, you certainly have to distrust systems of thought, cut off from scientific facts, which could lead reflection on these subjects astray, unless it was conducted by persons who were competent and well known for their breadth of view and their freedom of spirit.

[Question] What exactly are the ethical problems that the whole society risks confronting before the end of the century?

[Answer] Essentially, medical problems. You see it in the news, written as well as spoken. If there is anything that arouses anxiety, it is certainly that.

[Question] Genetic manipulation, for example.

[Answer] Which is called "genetic engineering". People no longer "manipulate". It was Jacques Monod who changed the term, understanding that the term "genetic manipulation" was a horrible term and that, whatever might be done under that heading, it would always be very suspect. But I am no more pessimistic on that subject than I am on many others. Nevertheless, one has no right to ignore these questions.

[Question] What question would you have liked to answer?

[Answer] Many people talk to me about the mobility of the researchers. It's a slightly hackneyed subject and one that irritates researchers, because they have the impression that people are trying to push them around like pawns on a board. Why them rather than some others? Moreover, this mobility question is well perceived by the researchers. They well know that they don't have the right to stay on the same idea, and that changing the idea sometimes involves changing the laboratory.

The important thing, on the other hand, is to give them good material conditions, let them have well-equipped labs--because the right lab environment leads to discovery. Fifty percent of the world's research is done in the United States and 7 or 8 percent in France. You may have flashes here and there--and there are some--, but the general tone is set by the United States. So, if the average equipment in our labs tended to become inferior to that of the United States, whatever was being done, whatever the quality of the minds, our production of research would not be as good.

[Question] Europe is perhaps a solution.

[Answer] Completely. And besides, good advances are being registered in the European unification of research. The last meeting of research ministers was a fruitful one. Research Europe is really being accomplished. But mind you, everyone must pull his own weight. It's not necessary to pull research up by the roots. While there are countries that are clearly behind, they don't have to hinder those that are ahead.

[Question] Would you agree with the proposal that consists of saying that it is necessary to "give everything we've got" to a certain number of sectors in which France is really in the lead?

[Answer] In development, yes.

[Question] Even if it means abandoning those in which it has fallen behind?

[Answer] There are obviously strategic sectors that we have no right to let go of. But, in development--I'm not saying it's necessary to attend to the most pressing things first--we aren't there yet--, but it really is necessary to determine in which sectors we have every chance, or better chances, of being successful. We must not lose sight of the fact that France accounts for 7 to 8 percent of the world's research--that isn't 50 percent--and that with this it has to manage to produce things of good quality. So, when basic research is involved, no problem. But when applied research is involved, mind you, you run up against a question of volume: things have to be done.

[Question] Do you think France's share is going to increase or diminish? Because 7 or 8 percent is already not so bad.

[Answer] It's not bad at all. It should go on increasing.

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SCIENTIFIC AND INDUSTRIAL POLICY

NORWAY FORMULATES LONG-TERM PLAN FOR INFORMATION TECHNOLOGY

Oslo AFTENPOSTEN in Norwegian 9 Nov 84 p 34

[Article by Ulf Peter Hellstrøm: "Several Organizations Behind Initiative: Action Plan for Information Industry"]

[Text] The electronics industry and agencies like the Norwegian Export Council and the Industry Foundation are now beginning work on working out a strategic plan for Norwegian information technology up to the year 2000. "Tomorrow's Norway will be dependent on how this branch of industry develops here at home. The Norwegian electronics industry is today losing market shares abroad," Electronics Industry Business Association Chairman Ralph Høibakk said when the initiative for an action plan was presented on Thursday.

Only seven percent of total Norwegian exports consist of information-intensive products, whereas Norway's trade partners within the OECD area have a percentage of 37. This comes from a perspective analysis of the Norwegian electronics industry which the industry association also presented during a press conference on Thursday.

The Norwegian electronics industry today employs 13,000 people and exports about 2.5 billion kroner worth annually. The combined rate of growth for the last three years has been 15 percent. However, Høibakk drew attention to the fact that the foreign markets within these branches of industry are showing a rate of growth which is even stronger.

"Compared to traditional Norwegian industry, the electronics and computer industries in Norway are both profitable, strongly growing and export-oriented. However, if we compare this little Norwegian branch of industry with comparable industries abroad, the picture becomes different. The Norwegian electronics industry is losing shares of the market abroad. It is disquieting to think that the extremely modest Norwegian domestic market requires internationalizing of the electronics industry," Høibakk said.

In addition to the organizations named by way of introduction, the Norwegian Council for Scientific and Industrial Research (NTNF), ELAB in Trondheim and the Telecommunications Agency are also involved in the project which is to produce an action plan for this field. The project leader will be Research Chief Karl Holberg of the Armed Forces Research Institute (FFI). According

to the plan, the first main conclusions are to be at hand well into the late winter, while the report is to be finished in its entirety during the first half of 1985.

To Year 2000

The action plan is to draw up goals for the broad Norwegian information technology industry up to the turn of the century. The plan is to contain a survey of the measures which the industry, authorities and other concerned parties must sent into motion in order to realize the goals.

[Question] Is there a criticism of the authorities' attitude toward the entry of new technologies into Norway in this initiative for such an action plan?

[Answer] "This was not the basis for the project, but the initiative itself shows that we would like to have seen that Norway had come further in its attitude toward this type of industry. In that case, any criticism can be directed just as much against the industry itself," Høibakk says.

Competitive Strength

"The growing electronics and information industry is to an increasing degree a prerequisite for the rest of industry in Norway being able to maintain its competitive strength. Electronics and data-based solutions are today being used in the products of other branches of industry. At the same time, the Norwegian electronics industry is small, in the Scandinavian context, too. The Norwegian industry branch's export share was down at 46 percent in 1980, and this with one of the world's smallest domestic markets. The export shares for the same industry in Denmark, Sweden and Finland were in the same year 73, 65 and 57 percent, respectively," Høibakk says.

If Norwegian electronics concerns are to get an opportunity to internationalize their business, their ability to develop competitive technologies and products must happen via, among other things, an extensive use of public development contracts with Norwegian industry, the initiative takers for the project believe. During the press conference reference was made, among other things, to the considerable contribution taking place abroad for the development of national information industries. Høibakk aired, among other things, the idea that the same requirements ought to be set for Norwegian electronics contracts as the authorities have established as political goals for Norwegian contracts for, among others, the oil business.

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INTERNATIONAL SYMPOSIUM DISCUSSES LAB-INDUSTRY TECH TRANSFER

Duesseldorf VDI NACHRICHTEN in German 28 Sep 84 p 6

/Text/ Science and especially technology transfer are key words that increasingly dominate public discussion. But what do they mean and what can science transfer accomplish as such? This question was pursued by an international symposium entitled "New Models of Cooperation Between College and Industry," staged by the Society for the Promotion of Science Transfer in Frankfurt on Main on 19 and 20 September.

Science is gaining more and more significance in all fields of our daily life. On the one hand, it arouses great hopes as regards the solution to many problems; on the other hand, however, it is also met with a kind of rejecting attitude. This ambivalence toward science was stressed by Professor Dr Mitter in his introductory remarks. One can understand science, he said, only through a better transfer of its results either to the users or to the public at large.

Professor Dr Sigurts (Stockholm) pointed out that the recent technology transfer boom was closely connected to the economic recession, that an industrial structural change toward new technologies should be initiated by means of technology transfer, and that, last but not least, the universities hope to open up new research possibilities through funds from industry. Sigurts hoped, however, that the current interest in technology transfer is not just a short-term phenomenon. The extent to which the universities are actually flexible enough to meet the special requirements particularly of medium-level industry was a question that was not answered.

Professor Dr Farkas (Budapest) used the example of Hungary to prove that interest ties between industry and the economy are as yet almost nonexistent in some countries.

But we in West Germany are still struggling with difficulties connected with smooth science transfer and even smooth mutual expression of interests in science and industry. Heinz Marloth (Frankfurt) was able to point out that initial steps have been taken in this direction but that great difficulties continue to exist especially in the college sector.

Transfer in Little Steps

Juergen Allesch reported that the new technology transfer agency of the Berlin Technical University so far managed to place 115 graduates in industry. But this is certainly only a drop in the bucket in view of the total number of university graduates.

Against the background of the prior reports, which, however, remain very much in the conceptual realm, Allesch as well as M. C. Guthrie--who reported on international aspects of technology transfer, giving the example of cooperation between Hoechst AG with Massachusetts General Hospital, as well as Dr. Schily (Witten-Herdecke) who described "tasks of the organization of the first German private university"--show how industry can be persuaded to make investments in research institutions and to engage in closer cooperation with them. The report by Ministerial Counsellor Schlegel (Duesseldorf), entitled "The Lessons Learned by the OECD in Science Transfer," proved that this is being done in various ways in different countries.

The question as to what science transfer and technology transfer in particular can accomplish however was by no means answered exhaustively even by this conference, nor were any "new models" offered. Dr. Busch, chancellor of the University of Frankfurt, emphasized that one must take great care not to turn technology transfer into a "golden calf" around which universities would dance in the hope of being able to boost their budget funds or politicians in the belief that they have found the key here for pointing industry in the direction toward fundamental modernization. Professor Boehme (Darmstadt) in his report entitled "Cooperation Between Social Sciences and Economics," subscribed to the conviction that the universities could hardly do justice to the expectations of industry but that, on the other hand, the real task of the universities could not be to guide industry in new directions.

Instead it is industry's task to turn out competent graduates and thus to supply the intellectual prerequisites for successful economic development.

Industry Must Express Itself More Clearly

But what are industry's interests? This question was not answered because, interestingly enough, the representatives of the economy were hardly present during the conference or at least did not speak out. It is especially medium-level industry--which at any rate employs 70 percent of West Germany's workers--which seems to have little confidence in the colleges to support it successfully in its economic growth. The conference sometimes created the impression that science and technology transfer are not so much a serious problem for the economy but that instead a new field of academic endeavor begins to emerge here.

On the other hand, there could hardly be any doubt that interested scientists and interested entrepreneurs always found ways to work

together even without transfer agencies at the universities. It is especially the technical colleges that would constitute sufficient evidence for this also in the historical perspective.

Finally it was also pointed out that the rather considerable gap between medium-level industry and the university could be the result of a "me no speak your language" syndrome on both sides.

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